235. Firm power may also be called prime power.

236. Hot reserve is that generating capacity which is not in operation but can be made available for the service.

237. Spinning reserve is that reserve generating capacity which is connected to the bus and is ready to take the load.

238. Interest is the difference between money borrowed and money returned.

239. Straight line method of calculating depreciation cost is most cumbersome and is rarely used.

240. Sinking fund method is based on the conception that the annual uniform deduction from income for depreciation will accumulate to the capital value of the plant at the end of the life of the plant or equipment.

241. Maintenance includes periodic cleaning, greasing, adjustments and overhauling of the equipment.

242. As the capacity of the unit decreases there is a corresponding reduction in floor space per kW.

243. Primemovers used for industrial purpose should be non-condensing so that steam after exhausting could be used for processing.

244. As the capacity of diesel engines is limited therefore they are not suitable for bigger power stations.

245. Diesel power stations should be worked for fluctuating loads or as standby.

246. Running of large sets for long periods at lower than maximum continuous rating decreases the cost of unit generated.

247. The useful life of a power plant is that after which repairs become so frequent and extensive that it is found economical to replace the power plant by a new one.

248. The useful life of a diesel power plant is about 70 years.

249. The fixed charges of a hydro-plant depend upon the station output.

250. The general input-output may be represented as follows :

$$I = a + bL + cL^2 + dL^3$$

where I = Input

L = Output

a, b, c and d = Constants.

251. Incremental rate is defined as the ratio of additional input required to increase additional output.

252. Hopkinson demand rate method charges the consumer according to his maximum demand only.

253. The main feature of the tidal cycle is the difference in water surface elevations at the high tide and at the low tide.

254. Sedimentation and silteration of basins are the problems associated with tidal power plants.

255. The solar farm consists of a whole field covered with parabolic trough concentrators.

256. In case of 'solar farm' temperature at the point of focus can reach several thousand degrees celsius.

257. Geothermal energy is the heat from high pressure steam coming from within the earth.

258. The source of heat for a thermoelectric generator may be a small oil or gas burner, a radio-isotope or direct solar radiation.

259. Work function is defined as the energy required to extract an electron from the metal.

260. A solar cell is much different from a photovoltaic cell.

261. A solar cell is very costly.

262. MHD generator is a device which converts the heat energy of a fuel directly into electrical energy without a conventional electric generator.

263. By two-wire generators are meant such generators as have only two line terminals, one known as the positive terminal and the other as the negative terminal.
264. An electrical generator is a machine which converts electrical energy into mechanical energy.
265. The action of the cumulator is to reverse connections to the external circuit simultaneously and at the same instant the direction of e.m.f. reverses in each of the coil sides.
266. The output e.m.f. of an electrical generator may be made less pulsating by using a small number of coils and cummutator segments.
267. The armature of a d.c. machines is built up of thin laminations of low loss silicon steel.
268. In d.c. machines two layer winding with diamond shaped coils is used.
269. The use of copper brushes is made for machines designed for small currents at high voltages.
270. Box type brush holders are used in all ordinary d.c. machines.
271. The differential compound generator is used as a constant current generator for the same constant current applications as the series generator.
272. The exciter is generally a series wound d.c. machine.
273. The gaseous hydrogen is better cooling medium than air.
274. A transformer operates on the principle of mutual inductance between two (and sometimes more) inductively coupled coils.
275. One 3-phase transformer is costlier than three single-phase transformers.
276. Three-phase transformers are much more difficult and costlier to repair than single-phase transformers.
277. The switchgear constitutes all parts or equipments of the power plant whose function is to receive and distribute electric power.
278. Fuses are used to protect circuits of very high capacity against abnormal currents.
279. The function of a circuit breaker is to break a circuit when various abnormal conditions arise and create a danger for electrical equipment in an installation.
280. Earthing provides improved lightning protection.
281. Steel towers are rarely used.
282. Poreclain has very good electrical characteristics as well as high mechanical strength.
283. The substations serve as sources of energy supply for local areas of distribution in which these are located.
284. Pole-mounted substations are very costly.
285. Some substations are simply switching stations.

ANSWERS

1. Yes	**2.** No	**3.** No	**4.** Yes	**5.** No	**6.** Yes	**7.** Yes
8. No	**9.** Yes	**10.** Yes	**11.** No	**12.** No	**13.** Yes	**14.** No
15. No	**16.** Yes	**17.** No	**18.** No	**19.** No	**20.** Yes	**21.** No
22. Yes	**23.** Yes	**24.** Yes	**25.** Yes	**26.** No	**27.** Yes	**28.** No
29. Yes	**30.** Yes	**31.** Yes	**32.** No	**33.** Yes	**34.** Yes	**35.** Yes
36. No	**37.** Yes	**38.** Yes	**39.** No	**40.** Yes	**41.** Yes	**42.** Yes
43. Yes	**44.** No	**45.** Yes	**46.** No	**47.** Yes	**48.** No	**49.** Yes
50. Yes	**51.** Yes	**52.** No	**53.** Yes	**54.** Yes	**55.** No	**56.** Yes
57. Yes	**58.** No	**59.** Yes	**60.** Yes	**61.** No	**62.** Yes	**63.** No
64. No	**65.** Yes	**66.** No	**67.** No	**68.** No	**69.** Yes	**70.** Yes
71. No	**72.** Yes	**73.** Yes	**74.** No	**75.** Yes	**76.** No	**77.** Yes
78. No	**79.** Yes	**80.** No	**81.** No	**82.** Yes	**83.** No	**84.** Yes

85. Yes	**86.** Yes	**87.** No	**88.** Yes	**89.** Yes	**90.** No	**91.** No
92. No	**93.** Yes	**94.** Yes	**95.** No	**96.** Yes	**97.** No	**98.** Yes
99. Yes	**100.** Yes	**101.** No	**102.** Yes	**103.** No	**104.** Yes	**105.** No
106. Yes	**107.** Yes	**108.** No	**109.** Yes	**110.** No	**111.** Yes	**112.** Yes
113. No	**114.** No	**115.** Yes	**116.** Yes	**117.** Yes	**118.** No	**119.** Yes
120. Yes	**121.** No	**122.** No	**123.** Yes	**124.** Yes	**125.** No	**126.** Yes
127. Yes	**128.** No	**129.** Yes	**130.** Yes	**131.** Yes	**132.** No	**133.** Yes
134. Yes	**135.** Yes	**136.** No	**137.** Yes	**138.** Yes	**139.** No	**140.** Yes
141. Yes	**142.** Yes	**143.** Yes	**144.** No	**145.** Yes	**146.** Yes	**147.** No
148. Yes	**149.** No	**150.** No	**151.** Yes	**152.** Yes	**153.** No	**154.** Yes
155. Yes	**156.** No	**157.** Yes	**158.** Yes	**159.** No	**160.** Yes	**161.** Yes
162. No	**163.** Yes	**164.** Yes	**165.** Yes	**166.** No	**167.** No	**168.** Yes
169. Yes	**170.** No	**171.** No	**172.** Yes	**173.** Yes	**174.** No	**175.** Yes
176. Yes	**177.** Yes	**178.** Yes	**179.** No	**180.** Yes	**181.** Yes	**182.** Yes
183. No	**184.** Yes	**185.** Yes	**186.** No	**187.** Yes	**188.** No	**189.** Yes
190. Yes	**191.** No	**192.** Yes	**193.** Yes	**194.** No	**195.** No	**196.** Yes
197. Yes	**198.** No	**199.** Yes	**200.** No	**201.** No	**202.** Yes	**203.** Yes
204. No	**205.** Yes	**206.** Yes	**207.** No	**208.** Yes	**209.** No	**210.** Yes
211. Yes	**212.** No	**213.** Yes	**214.** No	**215.** No	**216.** Yes	**217.** No
218. Yes	**219.** Yes	**220.** No	**221.** Yes	**222.** No	**223.** Yes	**224.** Yes
225. No	**226.** Yes	**227.** Yes	**228.** No	**229.** Yes	**230.** No	**231.** Yes
232. No	**233.** Yes	**234.** Yes	**235.** No	**236.** No	**237.** Yes	**238.** Yes
239. No	**240.** Yes	**241.** Yes	**242.** No	**243.** Yes	**244.** Yes	**245.** Yes
246. No	**247.** Yes	**248.** No	**249.** Yes	**250.** Yes	**251.** Yes	**252.** No
253. Yes	**254.** Yes	**255.** Yes	**256.** No	**257.** Yes	**258.** Yes	**259.** Yes
260. No	**261.** Yes	**262.** Yes	**263.** Yes	**264.** No	**265.** Yes	**266.** No
267. Yes	**268.** Yes	**269.** No	**270.** Yes	**271.** Yes	**272.** No	**273.** Yes
274. Yes	**275.** No	**276.** Yes	**277.** Yes	**278.** No	**279.** Yes	**280.** Yes
281. No	**282.** Yes	**283.** Yes	**284.** No	**285.** Yes.		

ADDITIONAL/COMPETITIVE EXAMINATIONS QUESTIONS
(With Solutions-Comments)

A. Match List I with List II
B. Choose the Correct Answer

ADDITIONAL/COMPETITIVE EXAMINATIONS QUESTIONS
(Objective Type Questions)

A. ***Match Lists I and II and select the correct answer using the codes given below :***

1.

List I	List II
A. The maximum temperature that can be obtained by combustion of any fuel is listed by	1. nitrogen
B. The amount of matter evaporated in kg/kg of flue burnt.	2. boiler efficiency
C. Hydrogen in a fuel increases the ...... content in the flue gases	3. The dissociation of the products formed
D. The ratio of heat actually used in producing the steam to the heat liberated in the furnace.	4. Evaporation capacity of a boiler

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	3	4	1	2
(*c*)	4	2	1	3
(*d*)	4	3	2	1

2.

List I	List II
A. Heat value with products of combustion cooled to initial condition.	1. Carbon monoxide.
B. The amount of water evaporates from and at 100°C into dry and saturated steam.	2. One boiler horse power
C. The condition of incomplete combustion is sensed by measuring ... in fuel gas.	3. Equivalent evaporation from and at 100°C
D. The evaporation of 15.63 kg of water per hour from and at 100°C.	4. High heat value.

Codes :

	A	B	C	D
(*a*)	2	3	4	1
(*b*)	1	4	3	2
(*c*)	4	3	1	2
(*d*)	4	2	3	1

3.

List I	List II
A. Dissolved oxygen in feed water is removed by ...	1. stack effect
B. ...... reciprocating motion of the piston into rotary motion of crank.	2. cross head

C. ...... guides motion of the piston rod and prevents it from bending.	3. deaerator
D. ...... is caused by the difference in densities resulting from the difference in the temperature of two vertical columns of gas	4. connecting rod

Codes :

	A	B	C	D
(*a*)	3	4	2	1
(*b*)	3	2	1	4
(*c*)	2	3	4	1
(*d*)	4	2	3	1

4.

List I	List II
A. ...... provides reciprocating motion to the slide valve.	1. root-blowers
B. ...... are used to maintain boiler efficiency and capacity by the periodic removal of ash and slag from the heat absorbing surfaces.	2. eccentric
C. .... exhausts steam from the cylinder at proper moment.	3. dissolves oxygen
D. ...... is the greatest factor in the corrosion of steel surfaces in contact with water.	4. D-slide valve.

Codes :

	A	B	C	D
(*a*)	2	1	4	3
(*b*)	2	1	3	4
(*c*)	4	3	2	1
(*d*)	2	3	4	1

5.

List I	List II
A. ...... cycle is the accepted thermodynamic standard for comparing the performance of steam engines.	1. Condensation
B. ...... is used to prevent leakage of steam from the engine cylinder.	2. Rankine
C. ...... losses can be reduced by using cylinders in series.	3. Flywheel
D. ...... is employed to prevent fluctuation of speed.	4. Stuffing box

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	3	1	4

(c)	4	3	1	2
(d)	2	4	1	3

6.

List I	List II
A. In steam engine cylinders the losses are due to incomplete expansion, initial condensation, and	1. straight
B. For a steam engine the expansion phase on p-V diagram is	2. isentropic
C. For a steam engine with fixed cut off and variable initial pressure Willian's line is	3. logarithmic
D. The flow through nozzle is assumed to be	4. Throttling

Codes :

	A	B	C	D
(a)	1	4	3	2
(b)	4	3	1	2
(c)	4	2	3	1
(d)	3	4	2	1

7.

List I	List II
A. Blading efficiency is also known as ... efficiency.	1. De-lavel turbine
B. In ...... turbines, the exhaust steam is employed for some heating purpose.	2. higher
C. Stages with longer blades are ...... in efficiency compared to stages with short blade length.	3. back pressure
D. ...... is a single rotor impulse turbine.	4. diagram

Codes :

	A	B	C	D
(a)	2	4	3	1
(b)	1	2	3	4
(c)	4	3	2	1
(d)	4	3	1	2

8.

List I	List II
A. Ljungstrom turbine is a ...... reaction turbine.	1. aspect ratio
B. ...... is the ratio of blade length to steam passage width.	2. radial flow
C. ...... is the commonly used method for the governing of steam turbines.	3. parallel
D. In an axial flow turbine, the general direction of the steam flow is ...... to the turbine axis.	4. nozzle control governing

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	1	4	3
(*c*)	2	4	3	1
(*d*)	4	2	3	1

9.

List I	List II
A. ...... gives the highest thermal efficiency.	1. stoker
B. A...... is a power operated fuel feeding mechanism and grate.	2. velocity compounded
C. ...... impulse turbine has high steam consumption and low efficiency.	3. ejector
D. In an ...... the exhaust steam and cooling water mix in hollow truncated cones.	4. carnot cycle

Codes :

	A	B	C	D
(*a*)	4	1	2	3
(*b*)	4	2	3	1
(*c*)	3	4	2	1
(*d*)	4	2	3	1

10.

List I	List II
A. The process of removing dissolved oxygen is known as	1. bore
B. The inside diameter of the cylinder is called	2. storage
C. The water behind the dam at the plant is called	3. penstock
D. A ...... is a closed conduit for supplying water under pressure to turbine.	4. deaeration

Codes :

	A	B	C	D
(*a*)	2	3	4	1
(*b*)	4	1	2	3
(*c*)	4	2	3	1
(*d*)	3	4	2	1

11.

List I	List II
A. ...... is a tangential flow impulse turbine.	1. primary
B. ...... is a science which deals with the depletion and replenishment of water resources.	2. Pelton wheel

C. The firm power is also known as ...... power.	3. activity
D. The intensity of emitted radiation is termed	4. Hydrology

Codes :

	A	B	C	D
(*a*)	2	3	4	1
(*b*)	1	2	3	4
(*c*)	2	4	1	3
(*d*)	2	3	4	1

12.

List I	List II
A. Fission is accompanied by the emission of ...... and gamma rays.	1. enriched fuel
B. In a boiling water reactor ...... is used.	2. load factor
C. ...... is the ratio of average load to maximum demand.	3. diesel power stations
D. ...... should be worked for fluctuating loads or as standby.	4. neutrons

Codes :

	A	B	C	D
(*a*)	4	1	2	3
(*b*)	4	2	3	1
(*c*)	3	4	1	2
(*d*)	3	2	4	1

13.

List I	List II
A. When the nozzle operates with the maximum mass flow, the nozzle is said to be	1. labyrinth
B. A big factor in condenser performance is	2. non-condensable gases and air
C. The steam jet air ejector is used to remove ...... from condensers.	3. choked
D. Leakage loss of steam between inner circumference of stationary element and rotor is minimised by maintaining minimum practical clearance and by use of	4. tube cleanliness

Codes :

	A	B	C	D
(*a*)	1	2	4	3
(*b*)	2	3	4	1
(*c*)	3	2	4	1
(*d*)	3	4	2	1

14.

List I	List II
A. The process of maintaining the speed of a turbine constant for various load conditions is known as	1. cushion steam
B. The steam left in the clearance space from the previous stroke is called	2. governing
C. The pressure of intake steam remains unaltered in case of ...... governing.	3. both fixed and moving
D. In an impulse-reaction turbine, the pressure drops gradually and continuously over ...... blades.	4. cut-off

Codes :

	A	B	C	D
(*a*)	2	1	4	3
(*b*)	1	2	3	4
(*c*)	2	3	4	1
(*d*)	4	2	3	1

COMPETITIVE EXAMINATIONS QUESTIONS
(*With Solutions-Comments*)

B. *Choose the correct answer :*

***15.** A three-stage Rateau turbine is designed in such a manner that the first two stages develop equal power with identical velocity diagram while the third one develops more power with higher blade speed. In such a multistage turbine, the blade ring diameter

(*a*) is the same for all the three stages

(*b*) gradually increases from the first to the third stage

(*c*) of the third stage is greater than that of the first two stages

(*d*) of the third stage is less than that of the first two stages.

16. The presence of air in a condenser

(*a*) increases the pressure in the condenser and decreases the condensing coefficient

(*b*) decreases the pressure in the condenser but increases the condensing coefficient

(*c*) increases the pressure in the condenser as well as the condensing coefficient

(*d*) decreases the pressure in the condenser as well as the condensing coefficient.

***17.** Once throught boiler is named as such because

(*a*) flue gas passes only in one direction (*b*) there is no recirculation of water

(*c*) air is sent through the same direction (*d*) steam is sent out only in one direction.

***18.** In a steam condenser, the partial pressure of steam and air are 0.06 bar and 0.007 bar respectively. The condenser pressure is

(*a*) 0.067 bar (*b*) 0.06 bar

(*c*) 0.053 bar (*d*) 0.007 bar.

19. Cooling tower in a steam power station is a device for

(*a*) condensing the steam into water

(*b*) cooling the exhaust gases coming out of the boiler

(*c*) reducing the temperature of superheated steam

(*d*) reducing the temperature of cooling water used in condenser.

20. Which one of the following pairs is correctly matched ?

(*a*) Stage efficiency $= \dfrac{\text{actual enthalpy drop}}{\text{isentropic enthalpy drop}}$

(*b*) Nozzle efficiency $= \dfrac{\text{work delivered}}{\text{isentropic enthalpy drop}}$

(*c*) Diagram efficiency $= \dfrac{\text{work delivered by blades}}{\text{isentropic enthalpy drop}}$

(*d*) Blade efficiency $= \dfrac{\text{work done on moving blades}}{\text{actual enthalpy drop}}$.

21. With reference to supersaturated flow through a steam nozzle, which of the following statements are true ?

1. Steam is subcooled.
2. Mass flow rate is more than the equilibrium rate of flow.
3. There is loss in availability.
4. Index of expansion corresponds to wet steam conditions.

Select the correct answer using the codes given below :

Codes :

(*a*) 1, 2 and 3 (*b*) 1 and 2

(*c*) 1 and 4 (*d*) 2, 3 and 4.

22. Match List I with List II and select the correct answer using the codes given below the lists :

List I *(Name of steam turbine)*	**List II** *(Type of turbine)*
A. De-Laval turbine	1. Velocity compounded impulse turbine
B. Curtis turbine	2. Reaction turbine
C. Parsons turbine	3. Simple impulse turbine

Codes :

	A	B	C
(*a*)	1	3	2
(*b*)	2	1	3
(*c*)	3	1	2
(*d*)	3	2	1

23. Consider the following statements :

1. Almost all flow losses take place in the diverging part of a nozzle.
2. Normal shocks are likely to occur in the converging part of a nozzle.
3. Efficiency of reaction turbines is higher than that of impulse turbines.

Of these statements

(*a*) 1, 2 and 3 are correct (*b*) 2 and 3 are correct

(*c*) 1 and 2 are correct (*d*) 1 and 3 are correct.

24. A double acting steam engine with a cylinder diameter of 19 cm and a stroke of 30 cm has a cut-off of 0.35. The expansion ratio for this engine is nearly

(*a*) 1.05 (*b*) 2.85

(*c*) 6.65 (*d*) 10.05.

25. In an ideal impulse turbine, the

(*a*) absolute velocity at the inlet of moving blade is equal to that at the outlet

(*b*) relative velocity at the inlet of the moving blade is equal to that an the outlet

(*c*) axial velocity at the inlet is equal to that at the outlet

(*d*) whirl velocity at the inlet is equal to that at the outlet.

26. Symmetrical blading is used in a turbine when its degree of reaction is

(*a*) 25% (*b*) 50%

(*c*) 75% (*d*) 100%.

***27.** In a 50% reaction turbine stage, the tangential component of absolute velocity at rotor inlet is 537 m/s and blade velocity is 454 m/s. The power output in kW per kg of steam will be

(*a*) 302 (*b*) 282

(*c*) 260 (*d*) 248.

***28.** A single-stage impulse turbine with a diameter of 120 cm runs at 3000 rpm. If the blade speed ratio is 0.42, then the inlet velocity of steam will be

(*a*) 79 m/s (*b*) 188 m/s

(*c*) 450 m/s (*d*) 900 m/s.

29. The degree of reaction of a turbine is the ratio of enthalpy drop in

(*a*) moving blades to enthalpy drop in the stage

(*b*) fixed blades to enthalpy drop in the stage

(*c*) moving blades to enthalpy drop in fixed blades

(*d*) fixed blades to enthalpy drop in moving blades.

***30.** The given figure (Fig. 1) represents pressure and velocity variation for a

(*a*) reaction type turbine

(*b*) velocity compounded impulse turbine

(*c*) pressure-velocity compounded impulse turbine

(*d*) pressure compounded impulse turbine.

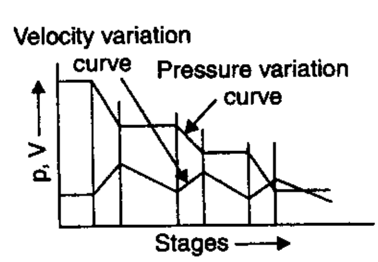


Fig. 1

31. Consider the following statements :

Blowdown is necessary on boilers, because

1. the boiler water level is lowered rapidly in case it accidentally rises too high.
2. the precipitated sediment or sludge is removed while the boiler is in service.
3. the concentration of suspended solids in the boiler is controlled.

Of these statements

(*a*) 1, 2 and 3 correct (*b*) 1 and 2 are correct

(*c*) 3 alone is correct (*d*) 1 and 3 are correct.

32. Energy conversion takes place only in one row of nozzle blades and later the steam glides over the rotor and guide blade rows in case of

(*a*) De-Laval turbine (*b*) Rateau turbine

(*c*) Parson's turbine (*d*) Curtis turbine. **[ESE-1994]**

33. The effect of friction on flow of steam through a nozzle is to

(*a*) decrease the mass flow rate and to increase the wetness at the exit

(*b*) increase the mass flow rate and to increase the exit temperature

(*c*) decrease the mass flow rate and to decrease the wetness of the steam

(*d*) increase the exit temperature, without any effect on the mass flow rate.

***34.** In a reaction turbine, the enthalpy drop in the fixed blade ring is 50 kJ per kg and the enthalpy drop in the moving blade ring is 25 kJ per kg. The degree of reaction of the turbine is

(*a*) 66.7% (*b*) 50.0%

(*c*) 33.3% (*d*) 6.0%.

35. Consider the following statements :

1. Boilers rated above 500 MW are not necessarily supercritical boilers.
2. Power plant boilers are generally once-through boilers.
3. Blow down at regular intervals is done to remove solids.

Of these statements

(*a*) 1, 2 and 3 correct (*b*) 1 and 2 are correct

(*c*) 2 and 3 correct (*d*) 1 and 3 are correct.

***36.** In a De-Laval nozzle expanding superheated steam from 10 bar to 0.1 bar, the pressure at the minimum cross-section will be

(*a*) 3.3 bar (*b*) 5.46 bar

(*c*) 8.2 bar (*d*) 9.9 bar.

37. Which one of the following indicates the correct order in the path of flue gas ?

(*a*) Super-heater, economiser, air pre-heater, precipitator

(*b*) Super-heater, economiser, precipitator, air-preheater

(*c*) Super-heater, precipitator, economiser, air pre-heater

(*d*) Super-heater, air pre-heater, economiser, precipitator.

38. Efficiency of nozzle governed turbine is affected mainly by losses due to

(*a*) partial admission (*b*) throttling

(*c*) interstage pressure drop (*d*) condensation in last stages.

39. Which of the following statements are *false* ?

1. Soot blowers are used generally in oil fired boilers.
2. There will be at least three safety valves on the boiler drum
3. Recuperative heating is better than regenerative heating in the case of air pre-heaters.

Select the correct answer using the codes given below :

Codes :

(*a*) 1, 2 and 3 (*b*) 1 and 2

(*c*) 2 and 3 (*d*) 1 and 3.

***40.** The isentropic enthalpy drop in moving blade is two-thirds of the isentropic enthalpy drop in fixed blades of a turbine. The degree of reaction will be

(*a*) 0.4 (*b*) 0.6

(*c*) 0.66 (*d*) 1.66.

41. The impulse turbine rotor efficiency will have a maximum value of $0.5 \cos^2 \alpha_1$ where α_1 is the nozzle exit flow angle, if the

(*a*) blades are equiangular (*b*) blade velocity coefficient is unity

(*c*) blades are equiangular and frictionless (*d*) blade solidity is 0.65.

42. For a Parson's reaction turbine, if α_1 and α_2 are fixed blade angles at inlet and exit respectively and β_1 and β_2 are the moving blade angles at entrance and exit respectively, then

(*a*) $\alpha_1 = \alpha_2$ and $\beta_1 = \beta_2$ (*b*) $\alpha_1 = \beta_1$ and $\alpha_2 = \beta_2$

(*c*) $\alpha_1 < \beta_1$ and $\alpha_2 > \beta_2$ (*d*) $\alpha_1 = \beta_2$ and $\beta_1 = \alpha_2$.

43. In the given figure, B_1, B_2, B_3 and B_4 represent blade passages in an impulse turbine. Consider the following statements in this regard

1. The solid line represents velocity variation.
2. The solid line represents pressure variation.
3. B_2 and B_4 are rotor passages.
4. B_1 and B_3 are rotor passages.

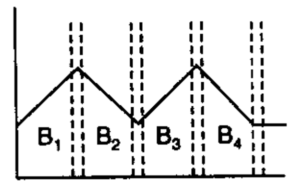


Fig. 2

Of these statements

(*a*) 1 and 4 are correct (*b*) 1 and 3 are correct

(*c*) 2 and 3 are correct (*d*) 2 and 4 are correct.

***44.** In a boiler, feed water supplied per hour is 205 kg while coal fired per hour is 23 kg. Net enthalpy rise per kg of water is 145 kJ for conversion to steam. If the calorific value of coal is 2050 kJ/kg then the boiler efficiency will be

(*a*) 78% (*b*) 74%

(*c*) 63% (*d*) 59%.

45. Match List I with List II and select the correct answer using the codes given below the lists :

List I	List II
A. Propeller turbine	1. Impulse turbine
B. Tangential turbine	2. Kaplan turbine
C. Reaction is zero	3. Gas turbine
D. Reaction turbine	4. Pelton turbine.

Codes :

	A	B	C	D
(*a*)	3	2	1	4
(*b*)	2	1	4	3
(*c*)	2	4	1	3
(*d*)	3	4	2	1

46. The characteristics of a pump are as shown in the given figure. Based on this figure, match List I with List II and choose the correct answer using the codes given below the lists :

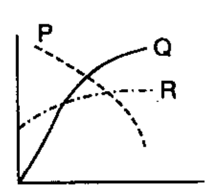


Fig. 3

List I	List II
A. Curve P	1. Discharge versus head
B. Curve Q	2. Head versus discharge
C. Curve R	3. Power versus discharge
	4. Efficiency versus discharge

Codes :

	A	B	C
(*a*)	2	4	3
(*b*)	1	3	2
(*c*)	1	4	3
(*d*)	4	3	1

***47.** In forced circulation boilers, about 90% of water is recirculated without evaporation. The circulation ratio is

(*a*) 0.1 (*b*) 0.9
(*c*) 9 (*d*) 10.

48. The excess air required for combustion of pulverised coal is of the order of

(*a*) 100 to 150% (*b*) 30 to 60%
(*c*) 15 to 40% (*d*) 5 to 10%.

49. Ratio of actual indicated work to hypothetical indicated work in a steam engine is the

(*a*) indicated thermal efficiency (*b*) friction factor
(*c*) mechanical efficiency (*d*) diagram factor.

50. Consider the following :

1. Increasing evaporation rate using convection heat transfer from hot gases.
2. Increasing evaporation rate using radiation.
3. Protecting the refractory walls of the furnace.
4. Increasing water circulation rate.

The main reasons for providing water wall enclosures in high pressure boiler furnaces would include

(*a*) 2 and 3 (*b*) 1 and 3
(*c*) 1 and 2 (*d*) 1, 2, 3 and 4.

51. Running speeds of steam turbines can be brought down to practical limits by which of the following method(s) ?

1. By using heavy flywheel 2. By using a quick response governor
3. By compounding 4. By reducing fuel feed to the furnace.

Choose the correct answer using the codes given below :

(*a*) 3 alone (*b*) 1, 2, 3 and 4
(*c*) 1, 2 and 4 (*d*) 2 and 3.

52. Consider the following statements :

Expansion joints in steam pipelines are installed to

1. allow for future expansion of plant.
2. take stresses away from flanges and fittings.
3. permit expansion of pipes due to temperature rise.

Of these statements :

(*a*) 1, 2 and 3 are correct (*b*) 1 and 2 are correct
(*c*) 2 and 3 are correct (*d*) 1 and 3 are correct.

53. In a surface condenser used in a steam power station, undercooling of condensate is *undesirable* as this would

(*a*) not absorb the gases in steam
(*b*) reduce efficiency of the plant

(c) increase the cooling water requirements

(d) increase thermal stresses in the condenser.

54. Of all the power plants, hydel is more disadvantageous when one compares the

(a) nearness to load centre (b) cost of energy resource

(c) technical skill required (d) economics that determine the choice of plant.

***55.** In thermal power plants, the deaerator is used mainly to

(a) remove air from condenser (b) increase feedwater temperature

(c) reduce steam pressure (d) reduce dissolved gases from feedwater.

56. In high pressure natural circulation boilers, the flue gases flow through the following boiler accessories :

1. Superheater 2. Air heater

3. Economiser 4. I.D. fan.

The correct sequence of the flow of flue gases through these boiler accessories is :

(a) 1, 3, 4, 2 (b) 3, 1, 4, 2

(c) 3, 1, 2, 4 (d) 1, 3, 2, 4.

57. Consider the following components :

1. Radiation evaporator 2. Economiser

3. Radiation superheater 4. Convection superheater.

In the case of a Benson boiler, the correct sequence of the entry of water through these components is :

(a) 1, 2, 3, 4 (b) 1, 2, 4, 3

(c) 2, 1, 3, 4 (d) 2, 1, 4, 3.

58. Coal fired power plant boilers manufactured in India generally use

(a) pulverised fuel combustion (b) fluidised bed combustion

(c) circulating fluidised bed combustion (d) moving stoker firing system.

59. The net result of pressure-velocity compounding of steam turbine is :

(a) less number of stages

(b) large turbine for a given pressure drop

(c) shorter turbine for a given pressure drop

(d) lower friction loss.

60. Consider the following statements :

When dry saturated or slightly superheated steam expands through a nozzle :

1. the coefficient of discharge is greater than unity.

2. it is dry upto Wilson's line.

3. expansion is isentropic throughout.

Of these statements :

(a) 1, 2 and 3 are correct (b) 1 and 2 are correct

(c) 1 and 3 are correct (d) 2 and 3 are correct.

61. The total and static pressures at the inlet of a steam nozzle are 186 kPa and 178 kPa respectively. If the total pressure at the exit is 180 kPa and static pressure is 100 kPa, then the loss of energy per unit mass in the nozzle will be

(a) 78 kPa (b) 8 kPa

(c) 6 kPa (d) 2 kPa.

62. Given,

V_b = blade speed

V = absolute velocity of steam entering the blade

α = nozzle angle,

the efficiency of an impulse turbine is maximum when

(*a*) $V_b = 0.5\ V \cos \alpha$ (*b*) $V_b = V \cos \alpha$

(*c*) $V_b = 0.5\ V^2 \cos \alpha$ (*d*) $V_b = V^2 \cos \alpha$.

***63.** An impulse turbine produces 50 kW of power when the blade mean speed is 400 m/s. What is the rate of change of momentum tangential to the rotor ?

(*a*) 200 N (*b*) 175 N

(*c*) 150 N (*d*) 125 N.

***64.** At a particular section of a reaction turbine, the diameter of the blade is 1.8 m, the velocity of flow of steam is 49 m/s and the quantity of steam flow is 5.4 m^3/s. The blade height at this section will be approximately

(*a*) 4 cm (*b*) 2 cm

(*c*) 1 cm (*d*) 0.5 cm.

65. Consider the following statements :

If steam is reheated during the expansion through turbine stages

1. erosion of blade will decrease
2. the overall pressure ratio will increase
3. the total heat drop will increase

Of these statements :

(*a*) 1, 2 and 3 are correct (*b*) 1 and 2 are correct

(*c*) 2 and 3 are correct (*d*) 1 and 3 are correct.

66. Which of the following power plants use heat recovery boilers (unfired) for steam generation ?

1. Combined cycle power plants
2. All thermal power plants using coal
3. Nuclear power plants
4. Power plants using fluidised bed combustion

Select the correct answer using the codes given below :

(*a*) 1 and 2 (*b*) 3 and 4

(*c*) 1 and 3 (*d*) 2 and 4.

67. Under ideal conditions, the velocity of steam at the outlet of a nozzle for a heat drop of 400 kJ/kg will be approximately

(*a*) 1200 m/s (*b*) 900 m/s

(*c*) 600 m/s (*d*) the same as the sonic velocity.

68. In an impulse-reaction turbine stage, the heat drop in fixed and moving blades are 15 kJ/kg and 30 kJ/kg respectively. The degree of reaction for this stage will be

(*a*) 1/3 (*b*) 1/2

(*c*) 2/3 (*d*) 3/4.

69. If 'D' is the diameter of the turbine wheel and 'U' is its peripheral velocity, then the disc friction loss will be proportional to

(a) $(DU)^3$ (b) D^2U^3

(c) D^3U^2 (d) DU^4.

70. Once-through boilers will NOT have

(a) drums, headers and pumps (b) drums, steam separators and pumps

(c) drums, headers and steam separators (d) drums, headers, steam separators and pumps.

***71.** A multistage compressor is to be designed for a given flow rate and prssure ratio. If the compressor consists of axial flow stages followed by centrifugal instead of only axial flow stages, then the

(a) overall diameter would be decreased

(b) overall diameter would be increased

(c) axial length of the compressor would be increased

(d) axial length of the compressor would be decreased.

72. The isothermal efficiency of a reciprocating compressor is defined as

(a) $\dfrac{\text{actual work done during compression}}{\text{isothermal work done during compression}}$

(b) $\dfrac{\text{adiabatic work done during compression}}{\text{isothermal work done during compression}}$

(c) $\dfrac{\text{isothermal work done during compression}}{\text{actual work done during compression}}$

(d) $\dfrac{\text{isothermal work done during compression}}{\text{actual work done during adiabatic compression}}$.

73. If the maximum temperature is T_3 and minimum temperature is T_1 then the optimum pressure ratio in a gas turbine is given by

(a) $r_p = \left(\dfrac{T_3}{T_1}\right)^{\frac{\gamma}{\gamma-1}}$ (b) $r_p = \left(\dfrac{T_3}{T_1}\right)^{\frac{\gamma-1}{2\gamma}}$

(c) $r_p = \left(\dfrac{T_3}{T_1}\right)^{\frac{\gamma-1}{2(\gamma-1)}}$ (d) $r_p = \left(\dfrac{T_3}{T_1}\right)^{\frac{2(\gamma-1)}{\gamma}}$

74. For one-dimensional isentropic flow in a diverging passage, if the initial static pressure is p_1 and the initial Mach number is $M_1(M_1 < 1)$, then for the downstream flow

(a) $M_2 < M_1 ; p_2 < p_1$ (b) $M_2 < M_1 ; p_2 > p_1$

(c) $M_2 > M_1 ; p_2 > p_1$ (d) $M_2 > M_1 ; p_2 < p_1$.

***75.** If the velocity of propagation of small disturbances in air at 27°C is 300 m/s, then at a temperature of 54°C, its speed would be

(a) 660 m/s (b) $300 \times \sqrt{2}$ m/s

(c) $300/\sqrt{2}$ m/s (d) $330 \times \sqrt{\dfrac{327}{300}}$ m/s.

76. In air-craft gas turbines, the axial flow compressor is preferred because

(a) of high pressure rise (b) it is stall free

(c) of low frontal area (d) of higher thrust.

77. In axial flow compressor, exit flow angle deviation from the blade angle is a function of
(*a*) blade camber (*b*) space-chord ratio
(*c*) both blade camber and space-chord ratio (*d*) blade camber and incidence angle.

***78.** The given figure represents a schematic view of the arrangement of a supersonic wind tunnel section. A normal shock can exist without affecting the test conditions.
(*a*) between sections 4 and 5
(*b*) at section 4
(*c*) between sections 4 and 3
(*d*) between sections 1 and 2.

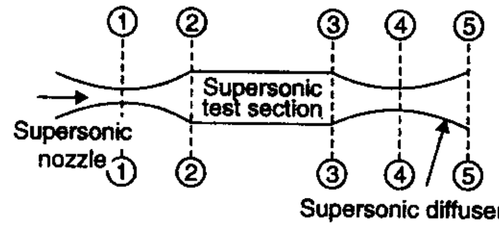


Fig. 4

79. Consider the following statements :
1. Reciprocating compressors are best suited for high pressure and low volume capacity.
2. The effect of clearance volume on power consumption is negligible for the same volume of discharge.
3. While the compressor is idling, the delivery valve is kept open by the control circuit.
4. Intercooling of air between the stages of compression helps to minimise losses.

Of these statements
(*a*) 1 and 2 are correct (*b*) 1 and 3 are correct
(*c*) 2 and 4 are correct (*d*) 3 alone is correct.

80. In a gas turbine cycle with two stages of reheating, working between maximum pressure p_1 and minimum pressure p_4 the optimum reheat pressures would be
(*a*) $(p_1p_4)^{1/3}$ and $(p_1p_4)^{2/3}$ (*b*) $(p_1^2p_4)^{2/3}$ and $(p_1p_4^2)^{1/3}$
(*c*) $\sqrt{p_1p_4}$ and $p_1\sqrt{p_4}$ (*d*) $(p_1p_4)^{1/2}$ and $(p_1p_4)^{2/3}$.

***81.** Intercooling in gas turbines
(*a*) decreases net output but increases thermal efficiency
(*b*) increases net output but decreases thermal efficiency
(*c*) decreases both net output and thermal efficiency
(*d*) increases both net output and thermal efficiency.

82. The thurst of a jet propulsion power unit can be increased by
(*a*) injecting water into the compressor
(*b*) burning fuel after gas turbine
(*c*) injecting ammonia into the combustion chamber
(*d*) all of the above.

***83.** The inlet and exit velocity diagrams of a turbomachine rotor are shown in Fig. 5. The turbomachine is
(*a*) an axial compressor with backward curved blades
(*b*) a radial compressor with backward curved blades
(*c*) a radial compressor with forward curved blades
(*d*) an axial compressor with forward curved blades.

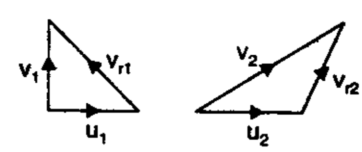


Fig. 5

84. Which of the following diagrams correctly depict the behaviour of compressible fluid flow in the given geometries ?

Select the correct answer using the codes given below :

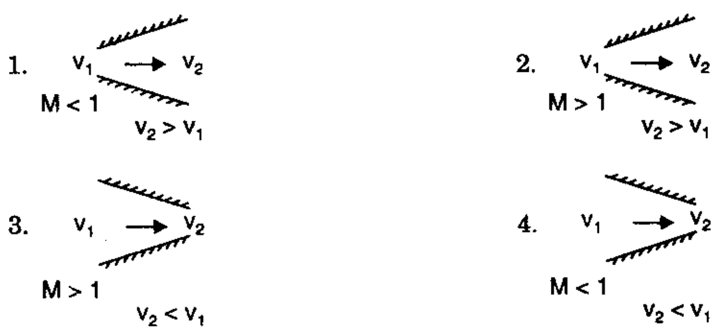


Fig. 6

Codes :

(*a*) 1 and 4 (*b*) 2 and 4

(*c*) 2 and 3 (*d*) 1 and 3.

85. Match List I with List II and select the correct answer using the codes given below the lists :

List I (*Name of propellant*)	**List II** (*Type of propellant*)
A. Nitric acid	1. Fuel
B. Hydrogen	2. Monopropellant
C. Fuming nitric acid-hydrazine	3. Oxidizer
D. Methyl nitratemethyl alcohol	4. Compounded liquid monopropellant
	5. Hypergolic propellant

Codes :

	A	B	C	D
(*a*)	2	1	4	5
(*b*)	1	2	5	4
(*c*)	3	1	5	4
(*d*)	3	1	4	5

***86.** For a multistage compressor, the polytropic efficiency is

(*a*) the efficiency of all stages combined together

(*b*) the efficiency of one stage

(*c*) constant throughout for all the stages

(*d*) a direct consequence of the pressure ratio.

***87.** Which of the following is the effect of blade shape on performance of a centrifugal compressor ?

(*a*) Backward curved blade has poor efficiency

(*b*) Forward curved blade has higher efficiency

(*c*) Backward curved blades lead to stable performance

(*d*) Forward curved blades produce lower pressure ratio.

88. Surging basically implies
(*a*) unsteady, periodic and reversed flow
(*b*) forward motion of air at a speed above sonic velocity
(*c*) the surging action due to the blast of air produced in a compressor
(*d*) forward movement of aircraft.

89. Which one of the following types of compressors is mostly used for supercharging of I.C. engines ?
(*a*) Radial flow compressor (*b*) Axial flow compressor
(*c*) Roots blower (*d*) Reciprocating compressor.

90. Phenomenon of choking in compressor means
(*a*) no flow of air
(*b*) fixed mass flow rate regardless of pressure ratio
(*c*) reducing mass flow rate with increase in pressure ratio
(*d*) increased inclination of chord with air stream.

91. Degree of reaction in an axial compressor is defined as the ratio of static enthalpy rise in the
(*a*) rotor to static enthalpy rise in the stator
(*b*) stator to static enthalpy rise in the rotor
(*c*) rotor to static enthalpy rise in the stage
(*d*) stator to static enthalpy rise in the stage.

92. The usual assumption in elementary compressor cascade theory is that
(*a*) axial velocity through the cascade changes
(*b*) for elementary compressor cascade theory, the pressure rise across the cascade is given by equation of state
(*c*) axial velocity through the cascade does not change
(*d*) with no change in axial velocity between inlet and outlet, the velocity diagram is formed.

***93.** Consider the following statements :
The volumetric efficiency of a compressor depends upon
1. clearance volume 2. pressure ratio
3. index of expansion
Of these statements
(*a*) 1 and 2 are correct (*b*) 1 and 3 are correct
(*c*) 2 and 3 are correct (*d*) 1, 2 and 3 are correct.

94. Induced draught fans of a large steam generator have
(*a*) backward curved blades (*b*) forward curved blades
(*c*) straight or radial blades (*d*) double curved blades.

95. Consider the following statements pertaining to isentropic flow :
1. To obtain stagnation enthalpy, the flow need not be decelerated isentropically but should be decelerated adiabatically.
2. The effect of friction in an adiabatic flow is to reduce the stagnation pressure and increase entropy.
3. A constant area tube with rough surfaces can be used as a subsonic nozzle.
Of these statements
(*a*) 1, 2 and 3 are correct (*b*) 1 and 2 are correct
(*c*) 1 and 3 are correct (*d*) 2 and 3 are correct.

96. Consider the following statements :

A convergent-divergent nozzle is said to be choked when

1. critical pressure is attained at the throat.
2. velocity at the throat becomes sonic.
3. exit velocity become supersonic.

Of these statements

(*a*) 1, 2 and 3 are correct (*b*) 1 and 2 are correct

(*c*) 2 and 3 are correct (*d*) 1 and 3 are correct.

97. In flow through a convergent nozzle, the ratio of back pressure to the inlet pressure is given by the relation

$$p_B/p_1 = \left[\frac{2}{\gamma+1}\right]^{\frac{\gamma}{\gamma-1}}$$

If the back pressure is lower than p_B given by the above equation,

(*a*) the flow in the nozzle is supersonic

(*b*) a shock wave exists inside the nozzle

(*c*) the gases expand outside the nozzle and a shock wave appears outside the nozzle

(*d*) a shock wave appears at the nozzle exit.

98. Consider the following statements :

Across the normal shock, the fluid properties change in such a manner that the

1. velocity of flow is subsonic
2. pressure increases
3. specific volume decreases
4. temperature decreases.

Of these statements

(*a*) 2, 3 and 4 are correct (*b*) 1, 2 and 4 are correct

(*c*) 1, 3 and 4 are correct (*d*) 1, 2 and 3 are correct.

99. When a system undergoes a process such that $\int \frac{dQ}{T} = 0$ and $\Delta s > 0$, the process is

(*a*) irreversible adiabatic (*b*) reversible adiabatic

(*c*) isothermal (*d*) isobaric.

100. Consider the following statements :

When a perfect gas enclosed in cylinder-piston device executes a reversible adiabatic expansion process.

1. its entropy will increase
2. its entropy change will be zero
3. the entropy change of the surroundings will be zero

Of these statements

(*a*) 1 and 3 are correct (*b*) 2 alone is correct

(*c*) 2 and 3 are correct (*d*) 1 alone is correct.

101. The heat rejection by a reciprocating air compressor during the reversible compression process AB, shown in the following temperature entropy diagram, is represented by the area

(*a*) ABC (*b*) ABDE

(*c*) ABFG (*d*) ABFOE.

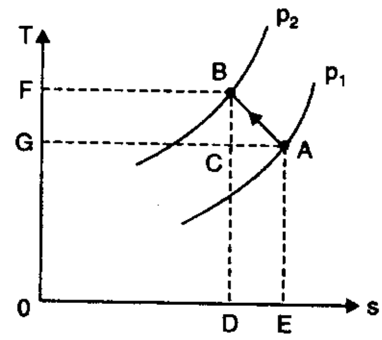


Fig. 7

102. Centrifugal compressors are suitable for large discharge and wider mass flow range, but at a relatively low discharge pressure of the order of 10 bar, because of

(*a*) low pressure ratio (*b*) limitation of size of receiver

(*c*) large speeds (*d*) high compression index.

103. Given :

V_{w2} = velocity of whirl at outlet

u_2 = peripheral velocity of the blade tips,

the degree of reaction in centrifugal compressor is equal to

(*a*) $1 - \frac{V_{w2}}{2_{u_2}}$ (*b*) $1 - \frac{u_2}{2V_{w2}}$

(*c*) $1 - \frac{2V_{w2}}{u_2}$ (*d*) $1 - \frac{V_{w2}}{u_2}$.

104. Match List I with List II (pertaining to blower performance) and select the correct answer using the codes given below the Lists :

List I	List II
A. Slip	1. Reduction of whirl velocity
B. Stall	2. Fixed mass flow rate regardless of pressure ratio
C. Choking	3. Flow separation
	4. Flow area reduction

Codes :

	A	B	C
(*a*)	4	3	2
(*b*)	1	3	2
(*c*)	4	1	3
(*d*)	2	3	4

***105.** In a gas turbine cycle, the turbine output is 600 kJ/kg, the compressor work is 400 kJ/kg and the heat supplied is 1000 kJ/kg. The thermal efficiency of this cycle is

(*a*) 80% (*b*) 60%

(*c*) 40% (*d*) 20%.

106. In a single-stage open-cycles gas turbine, the mass flow through the turbine is higher than the mass flow through compressor, because

(*a*) the specific volume of air increases by use of intercooler

(*b*) the temperature of air increases in the reheater

(*c*) the combustion of fuel takes place in the combustion chamber

(*d*) the specific heats at constant pressure for incoming air and exhaust gases are different.

107. The given figure shows the effect of the substitution of an isothermal compression process for the isentropic compression process on the gas turbine cycle. The shaded area (1-5-2-1) in the p-v diagram represents

(*a*) reduction in the compression work

(*b*) reduction in the specific volume

(*c*) increment in the compression work

(*d*) increment in the specific volume.

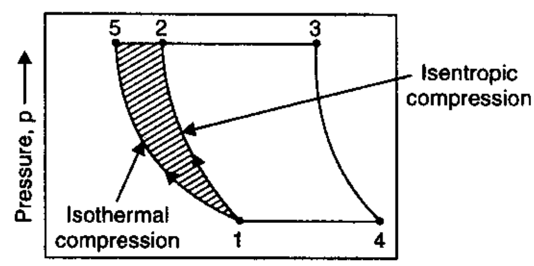


Fig. 8

***108.** A reaction turbine discharges 30 m^3/s of water under a head of 10 m with an overall efficiency of 92%. The power developed is :

(*a*) 295.2 kW (*b*) 287.0 kW

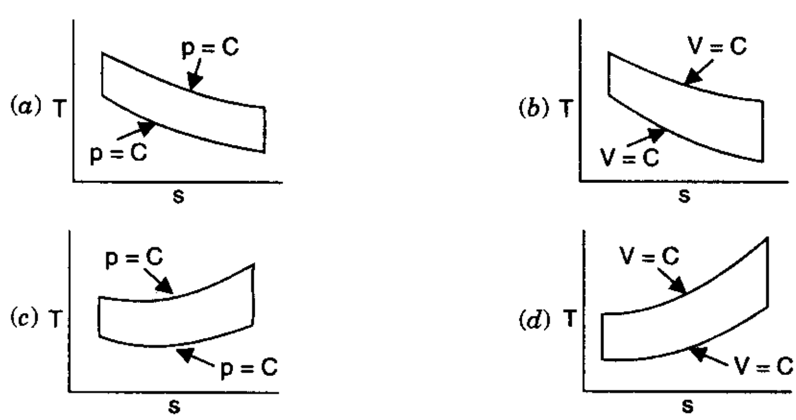
(*c*) 270.7 kW (*d*) 265.2 kW.

109. A gas turbine develops 120 kJ of work while the compressor absorbed 60 kJ of work and the heat supplied is 200 kJ. If a regenerator which would recover 40% of the heat in the exhaust were used, then the increase in the overall thermal efficiency would be

(*a*) 10.2% (*b*) 8.6%

(*c*) 6.9% (*d*) 5.7%.

110. Which one of the thermodynamic cycles shown in the following figures represents that of Brayton cycle ?



111. In some carburettors, meter rod and economiser device is used for

(*a*) cold starting (*b*) idling

(*c*) power enrichment (*d*) acceleration.

112. Which of the following pairs of engine and performance/characteristics is/are correctly matched ?

1. Turbojet—Efficiency increases with light speed
2. SI engine—Lowest specific fuel consumption
3. Turboprop—Suitable for low light speeds.

Select the correct answer using the codes given below :

(*a*) 1 and 2 (*b*) 2 and 3
(*c*) 1 and 3 (*d*) 2 alone.

113. Which one of the following is the correct sequence of the given components in a turboprop ?

(*a*) Propeller, Compressor, Turbine, Burner
(*b*) Compressor, Propeller, Burner, Turbine
(*c*) Propeller, Compressor, Burner, Turbine
(*d*) Compressor, Propeller, Turbine, Burner.

114. Consider the following statements :

The thrust of a rocket engine depends upon

1. effective jet velocity
2. weight of the rocket
3. rate of propellant consumption

Of these statements

(*a*) 1 and 2 are correct (*b*) 1 and 3 are correct
(*c*) 2 and 3 are correct (*d*) 1 , 2 and 3 are correct.

115. Consider the following statements : In a turbojet engine, thrust may be increased by

1. increasing the jet velocity.
2. increasing the mass flow rate of air
3. after burning of the fuel

Of these statements

(*a*) 1 and 2 are correct (*b*) 2 and 3 are correct
(*c*) 1 and 3 are correct (*d*) 1, 2 and 3 are correct.

116. The effective jet exit velocity from a rocket is 2700 m/s. The forward flight velocity is 1350 m/s. The propulsive efficiency of the unit is

(*a*) 200% (*b*) 100%
(*c*) 66.666% (*d*) 33.333%.

117. Consider the following statements regarding nuclear reactors :

1. In a gas-cooled thermal reactor, if CO_2 is used as the coolant, a separate moderator is not necessary as the gas contains carbon
2. Fast reactors using enriched uranium fuel do not require a moderator
3. In liquid metal-cooled fast breeder reactors, molten sodium is used as the coolant because of its high thermal conductivity
4. Fast reactors rely primarily on slow neutrons for fission.

Of these statements

(*a*) 1 and 2 are correct (*b*) 2 and 4 are correct
(*c*) 2 and 3 are correct (*d*) 1 and 3 are correct.

118. Which of the following form part(s) of boiler mountings ?

1. Economiser
2. Feed check valve
3. Steam trap
4. Superheater

Select the correct answer using the codes given below :

(*a*) 2 alone (*b*) 1 and 3

(*c*) 2, 3 and 4 (*d*) 1, 2, 3 and 4.

119. The energy transfer process is

(*a*) continuous in a reciprocating compressor and intermittent in an axial compressor

(*b*) continuous in an axial compressor and intermittent in a reciprocating compressor

(*c*) continuous in both reciprocating and axial compressors

(*d*) intermittent in both reciprocating and axial compressors.

120. In an axial flow compressor stage, air enters and leaves the stage axially. If the whirl component of the air leaving the rotor is half the mean peripheral velocity of the rotor blades, then the degree of reaction will be

(*a*) 1.00 (*b*) 0.75

(*c*) 0.50 (*d*) 0.25.

121. If an axial flow compressor is designed for a constant velocity through all stages, then the area of annulus of the succeeding stages will

(*a*) remain the same (*b*) progressively decrease

(*c*) progressively increase (*d*) depend upon the number of stages.

122. What will be the shape of the velocity triangle at the exit of a radial bladed centrifugal impeller, taking into account the slip ?

(*a*) Right-angled (*b*) Isosceles

(*c*) All angles less than 90° (*d*) One angle greater than 90°.

123. Which one of the following statements is true ?

(*a*) In a multi-stage compressor, adiabatic efficiency is less than stage efficiency

(*b*) In a multi-stage turbine, adiabatic efficiency is more than the stage efficiency

(*c*) Preheat factor for a multi-stage compressor is greater than one

(*d*) Preheat factor does not affect the multi-stage compressor performance.

124. At constant efficiency, the horse power of a fan is

(*a*) proportional to rpm (*b*) proportional to $(rpm)^2$

(*c*) proportional to $(rpm)^3$ (*d*) a polynomial function of rpm.

125. At the eye tip of a centrifugal impeller, blade velocity is 200 m/s while the uniform axial velocity at the inlet is 150 m/s. If the sonic velocity is 300 m/s, then the inlet Much number of the flow will be

(*a*) 0.50 (*b*) 0.66

(*c*) 0.83 (*d*) 0.87.

126. A gas turbine works on which one of the following cycles ?

(*a*) Brayton (*b*) Rankine

(*c*) Stirling (*d*) Otto.

127. Reheating in gas turbine

(*a*) increases the compressor work (*b*) decreases the compressor work

(*c*) increases the turbine work (*d*) decreases the turbine work.

128. Which one of the following forms of draft tube will NOT improve the hydraulic efficiency of the turbine ?

(*a*) Straight cylindrical (*b*) Conical type

(*c*) Bell-mouthed (*d*) Bent tube.

129. Which one of the following turbines is used in underwater power stations ?
(*a*) Pelton turbine (*b*) Deriaz turbine
(*c*) Tubular turbine (*d*) Turgo-impulse turbine.

130. A Pelton wheel is ideally suited for
(*a*) high head and low discharge (*b*) high head and high discharge
(*c*) low head and low discharge (*d*) medium head and medium discharge.

131. Consider the following turbine :
1. Kaplan 2. Pelton wheel
3. Francis
The correct sequence in increasing order of the specific speeds of these turbines is
(*a*) 2, 3, 1 (*b*) 2, 1, 3
(*c*) 3, 1, 2 (*d*) 1, 2, 3.

132. Consider the following statements regarding the specific speed of a centrifugal pump.
1. Specific speed is defined as the speed of a geometrically similar pump developing unit power under unit head.
2. At the same specific speed, the efficiency is greater with larger capacity.
3. The specific speed increases with the increase in outer blade angle.
4. The specific speed varies directly as the square root of the pump discharge.
Of these statements
(*a*) 1 and 2 are correct (*b*) 2 and 4 are correct
(*c*) 3 and 4 are correct (*d*) 2 and 3 are correct.

133. Which of the following purposes are served by the volute casing of a centrifugal pump ?
1. Increase in the efficiency of the pump.
2. Conversion of part of the pressure head to velocity head.
3. Giving uniform flow of the fluid coming out of the impeller.
Select the correct answer using the codes given below :
(*a*) 1 and 2 (*b*) 1 and 3
(*c*) 2 and 3 (*d*) 1, 2 and 3.

ANSWERS

Match Lists I and II :

1. (*b*)	**2.** (*c*)	**3.** (*a*)	**4.** (*a*)	**5.** (*d*)	**6.** (*b*)
7. (*c*)	**8.** (*b*)	**9.** (*a*)	**10.** (*b*)	**11.** (*c*)	**12.** (*a*)
13. (*d*)	**14.** (*a*)				

Competitive Examinations Questions :
Choose the correct Answer :

***15.** (*b*)	**16.** (*a*)	***17.** (*b*)	***18.** (*a*)	**19.** (*d*)	**20.** (*a*)
21. (*a*)	**22.** (*c*)	**23.** (*d*)	**24.** (*b*)	**25.** (*b*)	**26.** (*b*)
***27.** (*b*)	***28.** (*c*)	**29.** (*a*)	***30.** (*d*)	**31.** (*b*)	**32.** (*d*)
33. (*c*)	***34.** (*c*)	**35.** (*d*)	***36.** (*b*)	**37.** (*a*)	**38.** (*a*)
39. (*c*)	***40.** (*a*)	**41.** (*c*)	**42.** (*d*)	**43.** (*b*)	***44.** (*c*)
45. (*c*)	**46.** (*a*)	***47.** (*a*)	**48.** (*b*)	**49.** (*d*)	**50.** (*a*)

51. (*b*)	**52.** (*c*)	**53.** (*c*)	**54.** (*a*)	***55.** (*d*)	**56.** (*d*)
57. (*c*)	**58.** (*a*)	**59.** (*c*)	**60.** (*b*)	**61.** (*d*)	**62.** (*a*)
***63.** (*d*)	***64.** (*b*)	**65.** (*a*)	**66.** (*d*)	**67.** (*b*)	**68.** (*c*)
69. (*c*)	**70.** (*c*)	***71.** (*b*)	**72.** (*d*)	**73.** (*c*)	**74.** (*a*)
***75.** (*d*)	**76.** (*c*)	**77.** (*c*)	***78.** (*d*)	**79.** (*b*)	**80.** (*a*)
***81.** (*b*)	**82.** (*a*)	***83.** (*c*)	**84.** (*c*)	**85.** (*c*)	***86.** (*c*)
***87.** (*d*)	**88.** (*a*)	**89.** (*c*)	**90.** (*b*)	**91.** (*c*)	**92.** (*d*)
***93.** (*d*)	**94.** (*b*)	**95.** (*d*)	**96.** (*a*)	**97.** (*c*)	**98.** (*d*)
99. (*a*)	**100.** (*b*)	**101.** (*b*)	**102.** (*c*)	**103.** (*a*)	**104.** (*b*)
***105.** (*d*)	**106.** (*c*)	**107.** (*a*)	***108.** (*c*)	**109.** (*b*)	**110.** (*c*)
111. (*c*)	**112.** (*c*)	**113.** (*c*)	**114.** (*b*)	**115.** (*d*)	**116.** (*a*)
117. (*d*)	**118.** (*a*)	**119.** (*b*)	**120.** (*b*)	**121.** (*c*)	**122.** (*d*)
123. (*a*)	**124.** (*c*)	**125.** (*a*)	**126.** (*a*)	**127.** (*c*)	**128.** (*d*)
129. (*c*)	**130.** (*a*)	**131.** (*a*)	**132.** (*a*)	**133.** (*a*).	

SOLUTIONS-COMMENTS

15. (*b*) is the correct choice, since in multistage steam turbines the pressure drops in each stage and subsequently specific volume increases, therefore, to handle higher specific volume of steam the blade ring diameter (blade size) must gradually increase from the first to third stage.

17. The correct choice is (*b*) since once through boiler is one in which there is no recirculation of water as in case of natural or forced circulation boiler.

18. Condenser pressure = Partial pressure of steam (p_s) + partial pressure of air (p_{air})

$$= 0.06 + 0.007 = \mathbf{0.067\ bar\ (Ans.)}$$

Thus (*a*) is the correct choice.

27. In case of a 50% reaction turbine, the work done (W) is $= \dfrac{C_{bl}}{1000}(2C_1 \cos\alpha - C_{bl})$

[Where C_{bl} = blade velocity, C_1 = absolute velocity of steam
and α = nozzle angle, C_{bl} = 454 m/s, and $C_1 \cos\alpha$ = 537 m/s (Given)]

$$= \frac{454}{1000}(2 \times 537 - 454) = \mathbf{282\ kW/kg\ (Ans.)}$$

Thus (*b*) is correct choice.

28. Blade speed, $C_{bl} = \dfrac{\pi DN}{60} = \dfrac{\pi \times 1.2 \times 3000}{60} = 188.5$ m/s

$$\text{Blade speed ratio} = \frac{\text{blade speed } (C_{bl})}{\text{velocity of steam of entry } (C_1)}$$

or $0.42 = \dfrac{188.5}{C_1}$ or $C_1 = \dfrac{188.5}{0.42} \approx 450$ m/s **(Ans.)**

Thus (*c*) is the correct choice.

30. (*d*) is the correct choice because the total pressure gets dropped in three stages and in each stage the velocity increases in passing through the nozzle and then decreases in passing through blades (impulse stage).

34. Degree of reaction, $R_d = \dfrac{\Delta h(\text{moving blades})}{\Delta h(\text{moving blades}) + \Delta h(\text{fixed blades})}$

$= \dfrac{25}{25+50} = \dfrac{25}{75} = 0.333$ or **33.3% (Ans.)**

Thus (*c*) is the correct choice.

36. Throat pressure, $p_2 = p_1\left(\dfrac{2}{n+1}\right)^{\frac{n}{n-1}} = 10\left(\dfrac{2}{1.3+1}\right)^{\frac{1.3}{1.3-1}}$ = **5.46 bar (Ans.)**

(where n = 1.3, for superheated steam)

Thus the correct choice is (*b*).

40. Degree of reaction, $R_d = \dfrac{\Delta h(\text{moving blades})}{\Delta h(\text{moving blades}) + \Delta h(\text{fixed blades})}$

$= \dfrac{\frac{2}{3}\Delta h(\text{fixed blades})}{\frac{2}{3}\Delta h(\text{fixed blades}) + \Delta h(\text{fixed blades})} = \dfrac{\frac{2}{3}}{\frac{2}{3}+1}$ = **0.4 (Ans.)**

Thus (*a*) is the correct choice.

44. $\eta_{\text{boiler}} = \dfrac{\text{heat utilised}}{\text{heat supplied by coal}} = \dfrac{205 \times 145}{23 \times 2050}$ = 0.63 or **63% (Ans.)**

Thus (*c*) is the correct choice.

47. Circulation ratio is defined as reciprocal of percentage of the steam supplied in drum.

$\therefore$ Circulation ratio $= \dfrac{1}{0.1} = 10.$

55. The deaerator is used for removal of oxygen and CO_2 from boiler feed water and **process** water at elevated temperature to remove chances of corrosion.

63. Given : P = 50 × 10^3 watts ; Blade speed = 400 m/s

Rate of change of momentum tangential to rotor, N $= \dfrac{50 \times 10^3}{400}$ = **125**.

64. From continuity equation, $Q = AV$

or $5.4 = \pi dh \times V = \pi \times 1.8 \times h \times 49$

or $h = \dfrac{5.4}{\pi \times 1.8 \times 49} \times 100$ = **2 cm.**

71. The choice (*b*) is correct, because in case of axial flow stages, diameter is less and same but in case of ccentrifugal compressor, the flow is radial at outlet and hence overall diameter will increase.

75. Velocity of propagation of small disturbance, $V \propto \sqrt{T}$;

$\therefore \quad \dfrac{V_{54°C}}{V_{27°C}} = \dfrac{\sqrt{(54+273)}}{\sqrt{(27+273)}}$ or $\dfrac{V_{54°C}}{V_{27°C}} = \dfrac{\sqrt{327}}{\sqrt{300}}$

or $V_{54°C} = 330\sqrt{\dfrac{327}{300}}$ m/s **(Ans.)**

Thus (*d*) is the correct choice.

78. The correct choice is (*d*), because a normal shock can exist between 1 and 2 without affecting the test conditions, as it can be swallowed through the second throat by making it larger than first.

81. In a gas turbine, intercooling is employed to compressor air in two stages (with intercooling) ; the work done on the compressor decreases and consequently net output of turbine increases. However more heat has to be added in the combustion chamber which results in decrease in thermal efficiency.

83. From inlet and exist velocity diagrams of a turbomachine rotor it is evident that $u_2 > u_1$, which means that it is a *radial compressor* (for axial compressor $u_2 = u_1$). Further in outlet velocity triangle, Vr_2 is in the direction of u_2 which means blades are formed curved (in case of backward curved blades the direction of Vr_2 will be opposite to that of u_2, the angle between Vr_2 and u_2 will be acute). Thus (*c*) is the correct choice.

86. The polyopic efficiency is defined as the isentropic efficiency of an elemental stage of compressor which is constant throughout the whole process.

87. As reciprocating compressors are bulky, they are not used except for stationary installation and radial and axial flow compressors are not suitable due to problem of surging and high speed required for operation.

93. Volumetric efficiency $= 1 - k\left[\left(\frac{p_2}{p_1}\right)^{\frac{1}{n}} - 1\right]$

where, k = clearance volume ratio $= \frac{V_c}{V_s}$,

n = index of compression/expansion, $\frac{p_2}{p_1}$ = pressure ratio.

105. Given : $W_T = 600$ kJ/kg ; $W_C = 400$ kJ/kg ; $Q_{in} = 1000$ kJ/kg

$\therefore$ Thermal efficiency, $\eta = \frac{W_T - W_C}{Q_{in}} = \frac{600 - 400}{1000} \times 100 =$ **20%.**

108. Given : H = 10 m ; Q = 3 m³/s ; η = 92%

$$\eta = \frac{P}{wQH}$$

$\therefore$ $P = \eta wQH = 0.92 \times 9.81 \times 3 \times 10 =$ **270.7 kW.**

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(S.I. UNITS)

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SYMBOLS AND UNITS USED IN THE TABLES

t = Temperature, °C
t_s = Saturation temperature, °C
p = Pressure, bar
h_f = Specific enthalpy of saturated liquid, kJ/kg
h_{fg} = Specific enthalpy of evaporation (latent heat), kJ/kg
h_g = Specific enthalpy of saturated vapour, kJ/kg
s_f = Specific entropy of saturated liquid, kJ/kg K
s_{fg} = Specific entropy of evaporation, kJ/kg K
s_g = Specific entropy of saturated vapour, kJ/kg K
v_f = Specific volume of saturated liquid, m^3/kg
v_g = Specific volume of saturated steam, m^3/kg

TABLE I

Saturated Water and Steam (Temperature) Tables

Temp. (°C)	Absolute Pressure (bar)	Specific enthalpy (kJ/kg)			Specific entropy (kJ/kg K)			Specific volume (m^3/kg)	
t	p	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	v_f	v_g
0	0.0061	−0.02	2501.4	2501.3	−0.0001	9.1566	9.1565	0.0010002	206.3
0.01	0.0061	0.01	2501.3	2501.4	0.000	9.156	9.156	0.0010002	206.2
1	0.0065	4.2	2499.0	2503.2	0.015	9.115	9.130	0.0010002	192.6
2	0.0070	8.4	2496.7	2505.0	0.031	9.073	9.104	0.0010001	179.9
3	0.0076	12.6	2494.3	2506.9	0.046	9.032	9.077	0.0010001	168.1
4	0.0081	16.8	2491.9	2508.7	0.061	8.990	9.051	0.0010001	157.2
5	0.0087	21.0	2489.6	2510.6	0.076	8.950	9.026	0.0010001	147.1
6	0.0093	25.2	2487.2	2512.4	0.091	8.909	9.000	0.0010001	137.7
7	0.0100	29.4	2484.8	2514.2	0.106	8.869	8.975	0.0010002	129.0
8	0.0107	33.6	2482.5	2516.1	0.121	8.829	8.950	0.0010002	120.9
9	0.0115	37.8	2480.1	2517.9	0.136	8.789	8.925	0.0010003	113.4
10	0.0123	42.0	2477.7	2519.7	0.151	8.750	8.901	0.0010004	106.4
11	0.0131	46.2	2475.4	2521.6	0.166	8.711	8.877	0.0010004	99.86
12	0.0140	50.4	2473.0	2523.4	0.181	8.672	8.852	0.0010005	93.78
13	0.0150	54.6	2470.7	2525.3	0.195	8.632	8.828	0.0010007	88.12
14	0.0160	58.8	2468.3	2527.1	0.210	8.595	8.805	0.0010008	82.85
15	0.0170	63.0	2465.9	2528.9	0.224	8.557	8.781	0.0010009	77.93
16	0.0182	67.2	2463.6	2530.8	0.239	8.519	8.758	0.001001	73.33
17	0.0194	71.4	2461.2	2532.6	0.253	8.482	8.735	0.001001	69.04
18	0.0206	75.6	2458.8	2534.4	0.268	8.444	8.712	0.001001	65.04
19	0.0220	79.8	2456.5	2536.3	0.282	8.407	8.690	0.001002	61.29
20	0.0234	84.0	2454.1	2538.1	0.297	8.371	8.667	0.001002	57.79
21	0.0249	88.1	2451.8	2539.9	0.311	8.334	8.645	0.001002	54.51
22	0.0264	92.3	2449.4	2541.7	0.325	8.298	8.623	0.001002	51.45
23	0.0281	96.5	2447.0	2543.5	0.339	8.262	8.601	0.001002	48.57
24	0.0298	100.7	2444.7	2545.4	0.353	8.226	8.579	0.001003	45.88
25	0.0317	104.9	2442.3	2547.2	0.367	8.191	8.558	0.001003	43.36
26	0.0336	109.1	2439.9	2549.0	0.382	8.155	8.537	0.001003	40.99
27	0.0357	113.2	2437.6	2550.8	0.396	8.120	8.516	0.001004	38.77
28	0.0378	117.4	2435.2	2552.6	0.409	8.086	8.495	0.001004	36.69
29	0.0401	121.6	2432.8	2554.5	0.423	8.051	8.474	0.001004	34.73
30	0.0425	125.8	2430.5	2556.3	0.437	8.016	8.453	0.001004	32.89

Temp. (°C)	Absolute Pressure (bar)	Specific enthalpy (kJ/kg)			Specific entropy (kJ/kg K)			Specific volume (m^3/kg)	
t	p	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	v_f	v_g
31	0.0450	130.0	2428.1	2558.1	0.451	7.982	8.433	0.001005	31.17
32	0.0476	134.2	2425.7	2559.9	0.464	7.948	8.413	0.001005	29.54
33	0.0503	138.3	2423.4	2561.7	0.478	7.915	8.393	0.001005	28.01
34	0.0532	142.5	2421.0	2563.5	0.492	7.881	8.373	0.001006	26.57
35	0.0563	146.7	2418.6	2565.3	0.505	7.848	8.353	0.001006	25.22
36	0.0595	150.9	2416.2	2567.1	0.519	7.815	8.334	0.001006	23.94
37	0.0628	155.0	2413.9	2568.9	0.532	7.782	8.314	0.001007	22.74
38	0.0663	159.2	2411.5	2570.7	0.546	7.749	8.295	0.001007	21.60
39	0.0700	163.4	2409.1	2572.5	0.559	7.717	8.276	0.001007	20.53
40	0.0738	167.6	2406.7	2574.3	0.573	7.685	8.257	0.001008	19.52
41	0.0779	171.7	2404.3	2576.0	0.586	7.652	8.238	0.001008	18.57
42	0.0821	175.9	2401.9	2577.8	0.599	7.621	8.220	0.001009	17.67
43	0.0865	180.1	2399.5	2579.6	0.612	7.589	8.201	0.001009	16.82
44	0.0911	184.3	2397.2	2581.5	0.626	7.557	8.183	0.001010	16.02
45	0.0959	188.4	2394.8	2583.2	0.639	7.526	8.165	0.001010	15.26
46	0.1010	192.6	2392.4	2585.0	0.652	7.495	8.147	0.001010	14.54
47	0.1062	196.8	2390.0	2586.8	0.665	7.464	8.129	0.001011	13.86
48	0.1116	201.0	2387.6	2588.6	0.678	7.433	8.111	0.001011	13.22
49	0.1175	205.1	2385.2	2590.3	0.691	7.403	8.094	0.001012	12.61
50	0.1235	209.3	2382.7	2592.1	0.704	7.372	8.076	0.001012	12.03
52	0.1363	217.7	2377.9	2595.6	0.730	7.312	8.042	0.001013	10.97
54	0.1502	226.0	2373.1	2599.1	0.755	7.253	8.008	0.001014	10.01
56	0.1653	234.4	2368.2	2602.6	0.781	7.194	7.975	0.001015	9.149
58	0.1817	242.8	2363.4	2606.2	0.806	7.136	7.942	0.001016	8.372
60	0.1994	251.1	2358.5	2609.6	0.831	7.078	7.909	0.001017	7.671
62	0.2186	259.5	2353.6	2613.1	0.856	7.022	7.878	0.001018	7.037
64	0.2393	267.9	2348.7	2616.5	0.881	6.965	7.846	0.001019	6.463
66	0.2617	276.2	2343.7	2619.9	0.906	6.910	7.816	0.001020	5.943
68	0.2859	284.6	2338.8	2623.4	0.930	6.855	7.785	0.001022	5.471
70	0.3119	293.0	2333.8	2626.8	0.955	6.800	7.755	0.001023	5.042
75	0.3858	313.9	2321.4	2635.3	1.015	0.667	7.682	0.001026	4.131
80	0.4739	334.9	2308.8	2643.7	1.075	6.537	7.612	0.001029	3.407
85	0.5783	355.9	2296.0	2651.9	1.134	6.410	7.544	0.001033	2.828
90	0.7014	376.9	2283.2	2660.1	1.192	6.287	7.479	0.001036	2.361
95	0.8455	397.9	2270.2	2668.1	1.250	6.166	7.416	0.001040	1.982
100	1.0135	419.0	2257.0	2676.0	1.307	6.048	7.355	0.001044	1.673

TABLE II

Saturated Water and Steam (Pressure) Tables

Absolute Pressure (bar)	*Temp. (°C)*	*Specific enthalpy (kJ/kg)*			*Specific entropy (kJ/kg K)*			*Specific volume (m^3/kg)*	
p	t_s	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	v_f	v_g
0.006113	0.01	0.01	2 501.3	2 501.4	0.000	9.156	9.156	0.0010002	206.14
0.010	7.0	29.3	2 484.9	2 514.2	0.106	8.870	8.976	0.0010000	129.21
0.015	13.0	54.7	2 470.6	2 525.3	0.196	8.632	8.828	0.0010007	87.98
0.020	17.0	73.5	2 460.0	2 533.5	0.261	8.463	8.724	0.001001	67.00
0.025	21.1	88.5	2 451.6	2 540.1	0.312	8.331	8.643	0.001002	54.25
0.030	24.1	101.0	2 444.5	2 545.5	0.355	8.223	8.578	0.001003	45.67
0.035	26.7	111.9	2 438.4	2 550.3	0.391	8.132	8.523	0.001003	39.50
0.040	29.0	121.5	2 432.9	2 554.4	0.423	8.052	8.475	0.001004	34.80
0.045	31.0	130.0	2 428.2	2 558.2	0.451	7.982	8.433	0.001005	31.13
0.050	32.9	137.8	2 423.7	2 561.5	0.476	7.919	8.395	0.001005	28.19
0.055	34.6	144.9	2 419.6	2 565.5	0.500	7.861	8.361	0.001006	25.77
0.060	36.2	151.5	2 415.9	2 567.4	0.521	7.809	8.330	0.001006	23.74
0.065	37.6	157.7	2 412.4	2 570.1	0.541	7.761	8.302	0.001007	22.01
0.070	39.0	163.4	2 409.1	2 572.5	0.559	7.717	8.276	0.001007	20.53
0.075	40.3	168.8	2 406.0	2 574.8	0.576	7.675	8.251	0.001008	19.24
0.080	41.5	173.9	2 403.1	2 577.0	0.593	7.636	8.229	0.001008	18.10
0.085	42.7	178.7	2 400.3	2 579.0	0.608	7.599	8.207	0.001009	17.10
0.090	43.8	183.3	2 397.7	2 581.0	0.622	7.565	8.187	0.001009	16.20
0.095	44.8	187.7	2 395.2	2 582.9	0.636	7.532	8.168	0.001010	15.40
0.10	45.8	191.8	2 392.8	2 584.7	0.649	7.501	8.150	0.001010	14.67
0.11	47.7	199.7	2 388.3	2 588.0	0.674	7.453	8.117	0.001011	13.42
0.12	49.4	206.9	2 384.2	2 591.1	0.696	7.390	8.086	0.001012	12.36
0.13	51.0	213.7	2 380.2	2 593.9	0.717	7.341	8.058	0.001013	11.47
0.14	52.6	220.0	2 376.6	2 596.6	0.737	7.296	8.333	0.001013	10.69
0.15	54.0	226.0	2 373.2	2 599.2	0.754 9	7.254 4	8.009 3	0.001014	10.022
0.16	55.3	231.6	2 370.0	2 601.6	0.772 1	7.214 8	7.986 9	0.001015	9.433
0.17	56.6	236.9	2 366.9	2 603.8	0.788 3	7.177 5	7.965 8	0.001015	8.911
0.18	57.8	242.0	2 363.9	2 605.9	0.803 6	7.142 4	7.945 9	0.001016	8.445
0.19	59.0	246.8	2 361.1	2 607.9	0.818 2	7.109 0	7.927 2	0.001017	8.027
0.20	60.1	251.5	2 358.4	2 609.9	0.832 1	7.077 3	7.909 4	0.001017	7.650
0.21	61.1	255.9	2 355.8	2 611.7	0.845 3	7.047 2	7.892 5	0.001018	7.307
0.22	62.2	260.1	2 353.3	2 613.5	0.858 1	7.018 4	7.876 4	0.001018	6.995
0.23	63.1	264.2	2 350.9	2 615.2	0.870 2	6.990 8	7.861 1	0.001019	6.709
0.24	64.1	268.2	2 348.6	2 616.8	0.882 0	6.964 4	7.846 4	0.001019	6.447
0.25	65.0	272.0	2 346.4	2 618.3	0.893 2	6.939 1	7.832 3	0.001020	6.205
0.26	65.9	275.7	2 344.2	2 619.9	0.904 1	6.914 7	7.818 8	0.001020	5.980
0.27	66.7	279.2	2 342.1	2 621.3	0.914 6	6.891 2	7.805 8	0.001021	5.772
0.28	67.5	282.7	2 340.0	2 622.7	0.924 8	6.868 5	7.793 3	0.001021	5.579
0.29	68.3	286.0	2 338.1	2 624.1	0.934 6	6.846 6	7.781 2	0.001022	5.398

Absolute Pressure (bar)	Temp. (°C)	Specific enthalpy (kJ/kg)			Specific entropy (kJ/kg K)			Specific volume (m^3/kg)	
p	t_s	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	v_f	v_g
0.30	69.1	289.3	2 336.1	2 625.4	0.944 1	6.825 4	7.769 5	0.001022	5.229
0.32	70.6	295.5	2 332.4	2 628.0	0.962 3	6.785 0	7.747 4	0.001023	4.922
0.34	72.0	301.5	2 328.9	2 630.4	0.979 5	6.747 0	7.726 5	0.001024	4.650
0.36	73.4	307.1	2 325.5	2 632.6	0.995 8	6.711 1	7.707 0	0.001025	4.408
0.38	74.7	312.5	2 322.3	2 634.8	1.011 3	6.677 1	7.688 4	0.001026	4.190
0.40	75.9	317.7	2 319.2	2 636.9	1.026 1	6.644 8	7.670 9	0.001026	3.993
0.42	77.1	322.6	2 316.3	2 638.9	1.040 2	6.614 0	7.654 2	0.001027	3.815
0.44	78.2	327.3	2 313.4	2 640.7	1.053 7	6.584 6	7.638 3	0.001028	3.652
0.46	79.3	331.9	2 310.7	2 642.6	1.066 7	6.556 4	7.623 1	0.001029	3.503
0.48	80.3	336.3	2 308.0	2 644.3	1.079 2	6.529 4	7.608 6	0.001029	3.367
0.50	81.3	340.6	2 305.4	2 646.0	1.091 2	6.503 5	7.594 7	0.001030	3.240
0.55	83.7	350.6	2 299.3	2 649.9	1.119 4	6.442 8	7.562 3	0.001032	2.964
0.60	86.0	359.9	2 293.6	2 653.6	1.145 4	6.387 3	7.532 7	0.001033	2.732
0.65	88.0	368.6	2 288.3	2 656.9	1.169 6	6.336 0	7.505 5	0.001035	2.535
0.70	90.0	376.8	2 283.3	2 660.1	1.192 1	6.288 3	7.480 4	0.001036	2.369
0.75	92.0	384.5	2 278.6	2 663.0	1.213 1	6.243 9	7.457 0	0.001037	2.217
0.80	93.5	391.7	2 274.0	2 665.8	1.233 0	6.202 2	7.435 2	0.001039	2.087
0.85	95.1	398.6	2 269.8	2 668.4	1.251 8	6.162 9	7.414 7	0.001040	1.972
0.90	96.7	405.2	2 265.6	2 670.9	1.269 6	6.125 8	7.395 4	0.001041	1.869
0.95	98.2	411.5	2 261.7	2 673.2	1.286 5	6.090 6	7.377 1	0.001042	1.777
1.0	99.6	417.5	2 257.9	2 675.4	1.302 7	6.057 1	7.359 8	0.001043	1.694
1.1	102.3	428.8	2 250.8	2 679.6	1.333 0	5.994 7	7.327 7	0.001046	1.549
1.2	104.8	439.4	2 244.1	2 683.4	1.360 9	5.937 5	7.298 4	0.001048	1.428
1.3	107.1	449.2	2 237.8	2 687.0	1.386 8	5.884 7	7.271 5	0.001050	1.325
1.4	109.3	458.4	2 231.9	2 690.3	1.410 9	5.835 6	7.246 5	0.001051	1.236
1.5	111.3	467.1	2 226.2	2 693.4	1.433 6	5.789 8	7.223 4	0.001053	1.159
1.6	113.3	475.4	2 220.9	2 696.2	1.455 0	5.746 7	7.201 7	0.001055	1.091
1.7	115.2	483.2	2 215.7	2 699.0	1.475 2	5.706 1	7.181 3	0.001056	1.031
1.8	116.9	490.7	2 210.8	2 701.5	1.494 4	5.667 8	7.162 2	0.001058	0.977
1.9	118.6	497.8	2 206.1	2 704.0	1.5127	5.631 4	7.144 0	0.001060	0.929
2.0	120.2	504.7	2 201.6	2 706.3	1.530 1	5.596 7	7.126 8	0.001061	0.885
2.1	121.8	511.3	2 197.2	2 708.5	1.546 8	5.563 7	7.110 5	0.001062	0.846
2.2	123.3	517.6	2 193.0	2 710.6	1.5627	5.532 1	7.094 9	0.001064	0.810
2.3	124.7	523.7	2 188.9	2 712.6	1.578 1	5.501 9	7.080 0	0.001065	0.777
2.4	126.1	529.6	2 184.9	2 714.5	1.592 9	5.472 8	7.065 7	0.001066	0.746
2.5	127.4	535.3	2 181.0	2 716.4	1.607 1	5.444 9	7.052 0	0.001068	0.718
2.6	128.7	540.9	2 177.3	2 718.2	1.620 9	5.418 0	7.038 9	0.001069	0.693
2.7	129.9	546.2	2 173.6	2 719.9	1.634 2	5.392 0	7.026 2	0.001070	0.668
2.8	131.2	551.4	2 170.1	2 721.5	1.647 1	5.367 0	7.014 0	0.001071	0.646
2.9	132.4	556.5	2 166.6	2 723.1	1.659 5	5.342 7	7.0023	0.001072	0.625

Absolute Pressure (bar)	*Temp. (°C)*	*Specific enthalpy (kJ/kg)*			*Specific entropy (kJ/kg K)*			*Specific volume (m^3/kg)*	
p	t_s	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	v_f	v_g
3.0	133.5	561.4	2 163.2	2 724.7	1.671 6	5.319 3	6.990 9	0.001074	0.606
3.1	134.6	566.2	2 159.9	2 726.1	1.683 4	5.296 5	6.979 9	0.001075	0.587
3.2	135.7	570.9	2 156.7	2 727.6	1.694 8	5.274 4	6.969 2	0.001076	0.570
3.3	136.8	575.5	2 153.5	2 729.0	1.705 9	5.253 0	6.958 9	0.001077	0.554
3.4	137.8	579.9	2 150.4	2 730.3	1.716 8	5.232 2	6.948 9	0.001078	0.538
3.5	138.8	584.3	2 147.4	2 731.6	1.727 3	5.211 9	6.939 2	0.001079	0.524
3.6	139.8	588.5	2 144.4	2 732.9	1.737 6	5.192 1	6.929 7	0.001080	0.510
3.7	140.8	592.7	2 141.4	2 734.1	1.747 6	5.172 9	6.920 5	0.001081	0.497
3.8	141.8	596.8	2 138.6	2 735.3	1.757 4	5.154 1	6.911 6	0.001082	0.486
3.9	142.7	600.8	2 135.7	2 736.5	1.767 0	5.135 8	6.902 8	0.001083	0.473
4.0	143.6	604.7	2 133.0	2 737.6	1.776 4	5.117 9	6.894 3	0.001084	0.462
4.2	145.4	612.3	2 127.5	2 739.8	1.794 5	5.083 4	6.877 9	0.001086	0.441
4.4	147.1	619.6	2 122.3	2 741.9	1.812 0	5.050 3	6.862 3	0.001088	0.423
4.6	148.7	626.7	2 117.2	2 743.9	1.828 7	5.018 6	6.847 3	0.001089	0.405
4.8	150.3	633.5	2 112.2	2 745.7	1.844 8	4.988 1	6.832 9	0.001091	0.390
5.0	151.8	640.1	2 107.4	2 747.5	1.860 4	4.958 8	6.819 2	0.001093	0.375
5.2	153.3	646.5	2 102.7	2 749.3	1.875 4	4.930 6	6.805 9	0.001094	0.361
5.4	154.7	652.8	2 098.1	2 750.9	1.889 9	4.903 3	6.793 2	0.001096	0.348
5.6	156.2	658.8	2 093.7	2 752.5	1.904 0	4.876 9	6.780 9	0.001098	0.337
5.8	157.5	664.7	2 089.3	2 754.0	1.917 6	4.851 4	6.769 0	0.001099	0.326
6.0	158.8	670.4	2 085.0	2 755.5	1.930 8	4.826 7	6.757 5	0.001101	0.315
6.2	160.1	676.0	2 080.9	2 756.9	1.943 7	4.802 7	6.746 4	0.001102	0.306
6.4	161.4	681.5	2 076.8	2 758.2	1.956 2	4.779 4	6.735 6	0.001104	0.297
6.6	162.6	686.8	2 072.7	2 759.5	1.968 4	4.756 8	6.725 2	0.001105	0.288
6.8	163.8	692.0	2 068.8	2 760.8	1.980 2	4.734 8	6.715 0	0.001107	0.280
7.0	165.0	697.1	2 064.9	2 762.0	1.991 8	4.713 4	6.705 2	0.001108	0.273
7.2	166.1	702.0	2 061.1	2 763.2	2.003 1	4.692 5	6.695 6	0.001110	0.265
7.4	167.2	706.9	2 057.4	2 764.3	2.014 1	4.672 1	6.686 2	0.001111	0.258
7.6	168.3	711.7	2 053.7	2 765.4	2.024 9	4.652 2	6.677 1	0.001112	0.252
7.8	169.4	716.3	2 050.1	2 766.4	2.035 4	4.632 8	6.668 3	0.001114	0.246
8.0	170.4	720.9	2 046.5	2 767.5	2.045 7	4.613 9	6.659 6	0.001115	0.240
8.2	171.4	725.4	2 043.0	2 768.5	2.055 8	4.595 3	6.651 1	0.001116	0.235
8.4	172.4	729.9	2 039.6	2 769.4	2.065 7	4.577 2	6.642 9	0.001118	0.229
8.6	173.4	734.2	2 036.2	2 770.4	2.075 3	4.559 4	6.634 8	0.001119	0.224
8.8	174.4	738.5	2 032.8	2 771.3	2.084 8	4.542 1	6.626 9	0.001120	0.219
9.0	175.4	742.6	2 029.5	2 772.1	2.094 1	4.525 0	6.619 2	0.001121	0.215
9.2	176.3	746.8	2 026.2	2 773.0	2.103 3	4.508 3	6.611 6	0.001123	0.210
9.4	177.2	750.8	2 023.0	2 773.8	2.112 2	4.492 0	6.604 2	0.001124	0.206
9.6	178.1	754.8	2 019.8	2 774.6	2.121 0	4.475 9	6.596 9	0.001125	0.202
9.8	179.0	758.7	2 016.7	2 775.4	2.129 7	4.460 1	6.589 8	0.001126	0.198

Absolute Pressure (bar)	Temp. (°C)	Specific enthalpy (kJ/kg)			Specific entropy (kJ/kg K)			Specific volume (m^3/kg)	
p	t_s	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	v_f	v_g
10.0	179.9	762.6	2 013.6	2 776.2	2.138 2	4.444 6	6.582 8	0.001127	0.194
10.5	182.0	772.0	2 005.9	2 778.0	2.158 8	4.407 1	6.565 9	0.001130	0.185
11.0	184.1	781.1	1 998.5	2 779.7	2.178 6	4.371 1	6.549 7	0.001133	0.177
11.5	186.0	789.9	1 991.3	2 781.3	2.197 7	4.336 6	6.534 2	0.001136	0.170
12.0	188.0	798.4	1 984.3	2 782.7	2.216 1	4.303 3	6.519 4	0.001139	0.163
12.5	189.8	806.7	1 977.4	2 784.1	2.233 8	4.271 2	6.505 0	0.001141	0.157
13.0	191.6	814.7	1 970.7	2 785.4	2.251 0	4.240 3	6.491 3	0.001144	0.151
13.5	193.3	822.5	1 964.2	2 786.6	2.267 6	4.210 4	6.477 9	0.001146	0.146
14.0	195.0	830.1	1 957.7	2 787.8	2.283 7	4.181 4	6.465 1	0.001149	0.141
14.5	196.7	837.5	1 951.4	2 788.9	2.299 3	4.153 3	6.452 6	0.001151	0.136
15.0	198.3	844.7	1 945.2	2 789.9	2.314 5	4.126 1	6.440 6	0.001154	0.132
15.5	199.8	851.7	1 939.2	2 790.8	2.329 2	4.099 6	6.428 9	0.001156	0.128
16.0	201.4	858.6	1 933.2	2 791.7	2.343 6	4.073 9	6.417 5	0.001159	0.124
16.5	202.8	865.3	1 927.3	2 792.6	2.357 6	4.048 9	6.406 5	0.001161	0.120
17.0	204.3	871.8	1 921.5	2 793.4	2.371 3	4.024 5	6.395 7	0.001163	0.117
17.5	205.7	878.3	1 915.9	2 794.1	2.384 6	4.000 7	6.385 3	0.001166	0.113
18.0	207.1	884.6	1 910.3	2 794.8	2.397 6	3.977 5	6.375 1	0.001168	0.110
18.5	208.4	890.7	1 904.7	2 795.5	2.410 3	3.954 8	6.365 1	0.001170	0.107
19.0	209.8	896.8	1 899.3	2 796.1	2.422 8	3.932 6	6.355 4	0.001172	0.105
19.5	211.1	902.8	1 893.9	2 796.7	2.434 9	3.911 0	6.345 9	0.001174	0.102
20.0	212.4	908.6	1 888.6	2 797.2	2.446 9	3.889 8	6.336 6	0.001177	0.0995
20.5	213.6	914.3	1 883.4	2 797.7	2.458 5	3.869 0	6.327 6	0.001179	0.0971
21.0	214.8	920.0	1 878.2	2 798.2	2.470 0	3.848 7	6.318 7	0.001181	0.0949
21.5	216.1	925.5	1 873.1	2 798.6	2.481 2	3.828 8	6.310 0	0.001183	0.0927
22.0	217.2	931.0	1 868.1	2 799.1	2.492 2	3.809 3	6.301 5	0.001185	0.0907
22.5	218.4	936.3	1 863.1	2 799.4	2.503 0	3.790 1	6.293 1	0.001187	0.0887
23.0	219.5	941.6	1 858.2	2 799.8	2.513 6	3.771 3	6.284 9	0.001189	0.0868
23.5	220.7	946.8	1 853.3	2 800.1	2.524 1	3.752 8	6.276 9	0.001191	0.0849
24.0	221.8	951.9	1 848.5	2 800.4	2.534 3	3.734 7	6.269 0	0.001193	0.0832
24.5	222.9	957.0	1 843.7	2 800.7	2.544 4	3.716 8	6.261 2	0.001195	0.0815
25.0	223.9	962.0	1 839.0	2 800.9	2.554 3	3.699 3	6.253 6	0.001197	0.0799
25.5	225.0	966.9	1 834.3	2 801.2	2.564 0	3.682 1	6.246 1	0.001199	0.0783
26.0	226.0	971.7	1 829.6	2 801.4	2.573 6	3.665 1	6.238 7	0.001201	0.0769
26.5	227.1	976.5	1 825.1	2 801.6	2.583 1	3.648 4	6.231 5	0.001203	0.0754
27.0	228.1	981.2	1 820.5	2 801.7	2.592 4	3.632 0	6.224 4	0.001205	0.0740
27.5	229.1	985.9	1 816.0	2 801.9	2.601 6	3.615 8	6.217 3	0.001207	0.0727
28.0	230.0	990.5	1 811.5	2 802.0	2.610 6	3.599 8	6.210 4	0.001209	0.0714
28.5	231.0	995.0	1 807.1	2 802.1	2.619 5	3.584 1	6.203 6	0.001211	0.0701
29.0	232.0	999.5	1 802.6	2 802.2	2.628 3	3.568 6	6.196 9	0.001213	0.0689
29.5	233.0	1 004.0	1 798.3	2 802.2	2.637 0	3.553 3	6.190 2	0.001214	0.0677

Absolute Pressure (bar)	Temp. (°C)	Specific enthalpy (kJ/kg)			Specific entropy (kJ/kg K)			Specific volume (m^3/kg)	
p	t_s	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	v_f	v_g
30.0	233.8	1 008.4	1 793.9	2 802.3	2.645 5	3.538 2	6.183 7	0.001216	0.0666
30.5	234.7	1 012.7	1 789.6	2 802.3	2.653 9	3.523 3	6.177 3	0.001218	0.0655
31.0	235.6	1 017.0	1 785.4	2 802.3	2.662 3	3.508 7	6.170 9	0.001220	0.0645
31.5	236.5	1 021.2	1 781.1	2 802.3	2.670 5	3.494 2	6.164 6	0.001222	0.0634
32.0	237.4	1 025.4	1 776.9	2 802.3	2.678 6	3.479 9	6.158 5	0.001224	0.0624
32.5	238.3	1 029.6	1 772.7	2 802.3	2.686 6	3.465 7	6.152 3	0.001225	0.0615
33.0	239.2	1 033.7	1 768.6	2 802.3	2.694 5	3.451 8	6.146 3	0.001227	0.0605
33.5	240.0	1 037.8	1 764.4	2 802.2	2.702 3	3.438 0	6.140 3	0.001229	0.0596
34.0	240.9	1 041.8	1 760.3	2 802.1	2.710 1	3.424 4	6.134 4	0.001231	0.0587
34.5	241.7	1 045.8	1 756.3	2 802.1	2.717 7	3.410 9	6.128 6	0.001233	0.0579
35.0	242.5	1 049.8	1 752.2	2 802.0	2.725 3	3.397 6	6.122 8	0.001234	0.0570
35.5	243.3	1 053.7	1 748.2	2 801.8	2.732 7	3.384 4	6.117 1	0.001236	0.0562
36.0	244.2	1 057.6	1 744.2	2 801.7	2.740 1	3.371 4	6.111 5	0.001238	0.0554
36.5	245.0	1 061.4	1 740.2	2 801.6	2.747 4	3.358 5	6.105 9	0.001239	0.0546
37.0	245.7	1 065.2	1 736.2	2 801.4	2.754 7	3.345 8	6.100 4	0.001242	0.0539
37.5	246.5	1 069.0	1 732.3	2 801.3	2.761 8	3.333 2	6.095 0	0.001243	0.0531
38.0	247.3	1 072.7	1 728.4	2 801.1	2.768 9	3.320 7	6.089 6	0.001245	0.0524
38.5	248.1	1 076.4	1 724.5	2 800.9	2.775 9	3.308 3	6.084 2	0.001247	0.0517
39.0	248.8	1 080.1	1 720.6	2 800.8	2.782 9	3.296 1	6.078 9	0.001249	0.0511
39.5	249.6	1 083.8	1 716.8	2 800.5	2.789 7	3.284 0	6.073 7	0.001250	0.0504
40.0	250.3	1 087.4	1 712.9	2 800.3	2.796 5	3.272 0	6.068 5	0.001252	0.0497
41.0	251.8	1 094.6	1 705.3	2 799.9	2.809 9	3.248 3	6.058 3	0.001255	0.0485
42.0	253.2	1 101.6	1 697.8	2 799.4	2.823 1	3.225 1	6.048 2	0.001259	0.0473
43.0	254.6	1 108.5	1 690.3	2 798.9	2.836 0	3.202 3	6.038 3	0.001262	0.0461
44.0	256.0	1 115.4	1 682.9	2 798.3	2.848 7	3.179 9	6.028 6	0.001266	0.0451
45.0	257.4	1 122.1	1 675.6	2 797.7	2.861 2	3.157 9	6.019 1	0.001269	0.0440
46.0	258.7	1 128.8	1 668.3	2 797.0	2.873 5	3.136 2	6.009 7	0.001272	0.0430
47.0	260.1	1 135.3	1 661.1	2 796.4	2.885 5	3.114 9	6.000 4	0.001276	0.0421
48.0	261.4	1 141.8	1 653.9	2 795.7	2.897 4	3.093 9	5.991 3	0.001279	0.0412
49.0	262.6	1 148.2	1 646.8	2 794.9	2.909 1	3.073 3	5.982 3	0.001282	0.0403
50.0	263.9	1 154.5	1 639.7	2 794.2	2.920 6	3.052 9	5.973 5	0.001286	0.0394
51.0	265.1	1 160.7	1 632.7	2 793.4	2.931 9	3.032 8	5.964 8	0.001289	0.0386
52.0	266.4	1 166.8	1 625.7	2 792.6	2.943 1	3.013 0	5.956 1	0.001292	0.0378
53.0	267.6	1 172.9	1 618.8	2 791.7	2.954 1	2.993 5	5.947 6	0.001296	0.0371
54.0	268.7	1 178.9	1 611.9	2 790.8	2.965 0	2.974 2	5.939 2	0.001299	0.0363
55.0	269.9	1 184.9	1 605.0	2 789.9	2.975 7	2.955 2	5.930 9	0.001302	0.0356
56.0	271.1	1 190.8	1 598.2	2 789.0	2.986 3	2.936 4	5.922 7	0.001306	0.0349
57.0	272.2	1 196.6	1 591.4	2 788.0	2.996 7	2.917 9	5.914 6	0.001309	0.0343
58.0	273.3	1 202.3	1 584.7	2 787.0	3.007 1	2.899 5	5.906 6	0.001312	0.0336
59.0	274.4	1 208.0	1 578.0	2 786.0	3.017 2	2.881 4	5.898 6	0.001315	0.0330

Absolute Pressure (bar) p	Temp. (°C) t_s	Specific enthalpy (kJ/kg) h_f	h_{fg}	h_g	Specific entropy (kJ/kg K) s_f	s_{fg}	s_g	Specific volume (m^3/kg) v_f	v_g
60.0	275.5	1 213.7	1 571.3	2 785.0	3.027 3	2.863 5	5.890 8	0.001318	0.0324
61.0	276.6	1 219.3	1 564.7	2 784.0	3.037 2	2.845 8	5.883 0	0.001322	0.0319
62.0	277.7	1 224.8	1 558.0	2 782.9	3.047 1	2.828 3	5.875 3	0.001325	0.0313
63.0	278.7	1 230.3	1 551.5	2 781.8	3.056 8	2.810 9	5.867 7	0.001328	0.0308
64.0	279.8	1 235.7	1 544.9	2 780.6	3.066 4	2.793 8	5.860 1	0.001332	0.0302
65.0	280.8	1 241.1	1 538.4	2 779.5	3.075 9	2.776 8	5.852 7	0.001335	0.0297
66.0	281.8	1 246.5	1 531.9	2 778.3	3.085 3	2.760 0	5.845 2	0.001338	0.0292
67.0	282.8	1 251.8	1 525.4	2 777.1	3.094 6	2.743 3	5.837 9	0.001341	0.0287
68.0	283.8	1 257.0	1 518.9	2 775.9	3.103 8	2.726 8	5.830 6	0.001345	0.0283
69.0	284.8	1 262.2	1 512.5	2 774.7	3.112 9	2.710 5	5.823 3	0.001348	0.0278
70.0	285.8	1 267.4	1 506.0	2 773.5	3.121 9	2.694 3	5.816 2	0.001351	0.0274
71.0	286.7	1 272.5	1 499.6	2 772.2	3.130 8	2.678 2	5.809 0	0.001355	0.0269
72.0	287.7	1 277.6	1 493.3	2 770.9	3.139 7	2.662 3	5.802 0	0.001358	0.0265
73.0	288.6	1 282.7	1 486.9	2 769.6	3.148 4	2.646 5	5.794 9	0.001361	0.0261
74.0	289.6	1 287.7	1 480.5	2 768.3	3.157 1	2.630 9	5.788 0	0.001364	0.0257
75.0	290.5	1 292.7	1 474.2	2 766.9	3.165 7	2.615 3	5.781 0	0.001368	0.0253
76.0	291.4	1 297.6	1 467.9	2 765.5	3.174 2	2.599 9	5.774 2	0.001371	0.0249
77.0	292.3	1 302.5	1 461.6	2 764.2	3.182 7	2.584 6	5.767 3	0.001374	0.0246
78.0	293.2	1 307.4	1 455.3	2 762.8	3.191 1	2.569 5	5.760 5	0.001378	0.0242
79.0	294.1	1 312.3	1 449.1	2 761.3	3.199 4	2.554 4	5.753 8	0.001381	0.0239
80.0	294.9	1 317.1	1 442.8	2 759.9	3.207 6	2.539 5	5.747 1	0.001384	0.0235
81.0	295.8	1 321.9	1 436.6	2 758.4	3.215 8	2.524 6	5.740 4	0.001387	0.0232
82.0	296.7	1 326.6	1 430.3	2 757.0	3.223 9	2.509 9	5.733 8	0.001391	0.0229
83.0	297.5	1 331.4	1 424.1	2 755.5	3.232 0	2.495 2	5.727 2	0.001394	0.0225
84.0	298.4	1 336.1	1 417.9	2 754.0	3.239 9	2.480 7	5.720 6	0.001397	0.0222
85.0	299.2	1 340.7	1 411.7	2 752.5	3.247 9	2.466 3	5.714 1	0.001401	0.0219
86.0	300.1	1 345.4	1 405.5	2 750.9	3.255 7	2.451 9	5.707 6	0.001404	0.0216
87.0	300.9	1 350.0	1 399.3	2 749.4	3.263 6	2.437 6	5.701 2	0.001408	0.0213
88.0	301.7	1 354.6	1 393.2	2 747.8	3.271 3	2.423 5	5.694 8	0.001411	0.0211
89.0	302.5	1 359.2	1 387.0	2 746.2	3.279 0	2.409 4	5.688 4	0.001414	0.0208
90.0	303.3	1 363.7	1 380.9	2 744.6	3.286 7	2.395 3	5.682 0	0.001418	0.0205
91.0	304.1	1 368.3	1 374.7	2 743.0	3.294 3	2.381 4	5.675 7	0.001421	0.0202
92.0	304.9	1 372.8	1 368.6	2 741.4	3.301 8	2.367 6	5.669 4	0.001425	0.0199
93.0	305.7	1 377.2	1 362.5	2 739.7	3.309 3	2.353 8	5.663 1	0.001428	0.0197
94.0	306.4	1 381.7	1 356.3	2 738.0	3.316 8	2.340 1	5.656 8	0.001432	0.0194
95.0	307.2	1 386.1	1 350.2	2 736.4	3.324 2	2.326 4	5.650 6	0.001435	0.0192
96.0	308.0	1 390.6	1 344.1	2 734.7	3.331 5	2.312 9	5.644 4	0.001438	0.0189
97.0	308.7	1 395.0	1 338.0	2 733.0	3.338 8	2.299 4	5.638 2	0.001442	0.0187
98.0	309.4	1 399.3	1 331.9	2 731.2	3.346 1	2.285 9	5.632 1	0.001445	0.0185
99.0	310.2	1 403.7	1 325.8	2 729.5	3.353 4	2.272 6	5.625 9	0.001449	0.0183

Absolute Pressure (bar)	Temp. (°C)	Specific enthalpy (kJ/kg)			Specific entropy (kJ/kg K)			Specific volume (m^3/kg)	
p	t_s	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	v_f	v_g
100.0	311.1	1 408.0	1 319.7	2 727.7	3.360 5	2.259 3	5.619 8	0.001452	0.0181
102.0	312.4	1 416.7	1 307.5	2 724.2	3.374 8	2.232 8	5.607 6	0.001459	0.0176
104.0	313.8	1 425.2	1 295.3	2 720.6	3.388 9	2.206 6	5.595 5	0.001467	0.0172
106.0	315.3	1 433.7	1 283.1	2 716.9	3.402 9	2.180 6	5.583 5	0.001474	0.0168
108.0	316.6	1 442.2	1 270.9	2 713.1	3.416 7	2.154 8	5.571 5	0.001481	0.0164
110.0	318.0	1 450.6	1 258.7	2 709.3	3.430 4	2.129 1	5.559 5	0.001488	0.0160
112.0	319.4	1 458.9	1 246.5	2 705.4	3.444 0	2.103 6	5.547 6	0.001496	0.0157
114.0	320.7	1 467.2	1 234.3	2 701.5	3.457 4	2.078 3	5.535 7	0.001504	0.0153
116.0	322.1	1 475.4	1 222.0	2 697.4	3.470 8	2.053 1	5.523 9	0.001511	0.0149
118.0	323.4	1 483.6	1 209.7	2 693.3	3.484 0	2.028 0	5.512 1	0.001519	0.0146
120.0	324.6	1 491.8	1 197.4	2 689.2	3.497 2	2.003 0	5.500 2	0.001527	0.0143
122.0	325.9	1 499.9	1 185.0	2 684.9	3.510 2	1.978 2	5.488 4	0.001535	0.0139
124.0	327.1	1 508.0	1 172.6	2 680.6	3.523 2	1.953 3	5.476 5	0.001543	0.0137
126.0	328.4	1 516.0	1 160.1	2 676.1	3.536 0	1.928 6	5.464 6	0.001551	0.0134
128.0	329.6	1 524.0	1 147.6	2 671.6	3.548 8	1.903 9	5.452 7	0.001559	0.0131
130.0	330.8	1 532.0	1 135.0	2 667.0	3.561 6	1.879 2	5.440 8	0.001567	0.0128
132.0	332.0	1 540.0	1 122.3	2 662.3	3.574 2	1.854 6	5.428 8	0.001576	0.0125
134.0	333.2	1 547.9	1 109.5	2 657.4	3.586 8	1.830 0	5.416 8	0.001584	0.0123
136.0	334.3	1 555.8	1 096.7	2 652.5	3.599 3	1.805 3	5.404 7	0.001593	0.0120
138.0	335.5	1 563.7	1 083.8	2 647.5	3.611 8	1.780 7	5.392 5	0.001602	0.0117
140.0	336.6	1 571.6	1 070.7	2 642.4	3.624 2	1.756 0	5.380 3	0.001611	0.0115
142.0	337.7	1 579.5	1 057.6	2 637.1	3.636 6	1.731 3	5.367 9	0.001619	0.0112
144.0	338.8	1 587.4	1 044.4	2 631.8	3.649 0	1.706 6	5.355 5	0.001629	0.0110
146.0	339.9	1 595.3	1 031.0	2 626.3	3.661 3	1.681 8	5.343 1	0.001638	0.0108
148.0	341.1	1 603.1	1 017.6	2 620.7	3.673 6	1.656 9	5.330 5	0.001648	0.0106
150.0	342.1	1 611.0	1 004.0	2 615.0	3.685 9	1.632 0	5.317 8	0.001658	0.0103
152.0	343.2	1 618.9	990.3	2 609.2	3.698 1	1.607 0	5.305 1	0.001668	0.0101
154.0	344.2	1 626.8	976.5	2 603.3	3.710 3	1.581 9	5.292 2	0.001678	0.00991
156.0	345.3	1 634.7	962.6	2 597.3	3.722 6	1.556 7	5.279 3	0.001689	0.00971
158.0	346.3	1 642.6	948.5	2 591.1	3.734 8	1.531 4	5.266 3	0.001699	0.00951
160.0	347.3	1 650.5	934.3	2 584.9	3.747 1	1.506 0	5.253 1	0.001710	0.00931
162.0	348.3	1 658.5	920.0	2 578.5	3.759 4	1.480 6	5.239 9	0.001721	0.00911
164.0	349.3	1 666.5	905.6	2 572.1	3.771 7	1.455 0	5.226 7	0.001733	0.00893
166.0	350.3	1 67[illegible].5	891.0	2 565.5	3.784 2	1.429 0	5.213 2	0.001745	0.00874
168.0	351.3	1 683.0	875.6	2 558.6	3.797 4	1.402 1	5.199 4	0.001757	0.00855
170.0	352.3	1 691.7	859.9	2 551.6	3.810 7	1.374 8	5.185 5	0.001769	0.00837
172.0	353.2	1 700.4	844.0	2 544.4	3.824 0	1.347 3	5.171 3	0.001783	0.00819
174.0	354.2	1 709.0	828.1	2 537.1	3.837 2	1.319 8	5.157 0	0.001796	0.00801
176.0	355.1	1 717.6	811.9	2 529.5	3.850 4	1.292 2	5.142 5	0.001810	0.00784
178.0	356.0	1 726.2	795.6	2 521.8	3.863 5	1.264 3	5.127 8	0.001825	0.00767

Absolute Pressure (bar)	Temp. (°C)	Specific enthalpy (kJ/kg)			Specific entropy (kJ/kg K)			Specific volume (m^3/kg)	
p	t_s	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	v_f	v_g
180.0	356.9	1 734.8	779.1	2 513.9	3.876 5	1.236 2	5.112 8	0.001840	0.00750
182.0	357.8	1 743.4	762.3	2 505.8	3.889 6	1.207 9	5.097 5	0.001856	0.00733
184.0	358.7	1 752.1	745.3	2 497.4	3.902 8	1.179 2	5.082 0	0.001872	0.00717
186.0	359.6	1 760.9	727.9	2 488.8	3.916 0	1.150 1	5.066 1	0.001889	0.00701
188.0	360.5	1 769.7	710.1	2 479.8	3.929 4	1.120 5	5.049 8	0.001907	0.00684
190.0	361.4	1 778.7	692.0	2 470.6	3.942 9	1.090 3	5.033 2	0.001926	0.00668
192.0	362.3	1 787.8	673.3	2 461.1	3.956 6	1.059 4	5.016 0	0.001946	0.00652
194.0	363.2	1 797.0	654.1	2 451.1	3.970 6	1.027 8	4.998 3	0.001967	0.00636
196.0	364.0	1 806.6	634.2	2 440.7	3.984 9	0.995 1	4.980 0	0.001989	0.00620
198.0	364.8	1 816.3	613.5	2 429.8	3.999 6	0.961 4	4.961 1	0.002012	0.00604
200.0	365.7	1 826.5	591.9	2 418.4	4.014 9	0.926 3	4.941 2	0.002037	0.00588
202.0	366.5	1 837.0	569.2	2 406.2	4.030 8	0.889 7	4.920 4	0.002064	0.00571
204.0	367.3	1 848.1	545.1	2 393.3	4.047 4	0.851 0	4.898 4	0.002093	0.00555
206.0	368.2	1 859.9	519.5	2 379.4	4.065 1	0.809 9	4.875 0	0.002125	0.00538
208.0	368.9	1 872.5	491.7	2 364.2	4.084 1	0.765 7	4.849 8	0.002161	0.00521
210.0	369.8	1 886.3	461.3	2 347.6	4.104 8	0.717 5	4.822 3	0.002201	0.00502
212.0	370.6	1 901.5	427.4	2 328.9	4.127 9	0.663 9	4.791 7	0.002249	0.00483
214.0	371.3	1 919.0	388.4	2 307.4	4.154 3	0.602 6	4.756 9	0.002306	0.00462
216.0	372.1	1 939.9	341.6	2 281.6	4.186 1	0.529 3	4.715 4	0.002379	0.00439
218.0	372.9	1 967.2	280.8	2 248.0	4.227 6	0.434 6	4.662 2	0.002483	0.00412
220.0	373.7	2 011.1	184.5	2 195.6	4.294 7	0.285 2	4.579 9	0.002671	0.00373
221.2	374.1	2 107.4	0.0	2 107.4	4.442 9	0.0	4.442 9	0.003170	0.00317

TABLE III

Superheated Steam at Various Pressures and Temperatures

↓p (bar) (t_s)	t (°C) →	50	100	150	200	250	300	400	500
	v	149.1	172.2	195.3	218.4	241.5	264.5	310.7	356.8
0.01	u	2445.4	2516.4	2588.4	2661.6	2736.9	2812.2	2969.0	3132.4
(7.0)	h	2594.5	2688.6	2783.6	2880.0	2978.4	3076.8	3279.7	3489.2
	s	9.242	9.513	9.752	9.967	10.163	10.344	10.671	10.960
	v	29.78	34.42	39.04	48.66	48.28	52.9	62.13	71.36
0.05	u	2444.8	2516.2	2588.4	2661.9	2736.6	2812.6	2969.6	3133.0
(32.9)	h	2593.7	2688.1	2783.4	2879.9	2977.6	3076.7	3279.7	3489.2
	s	8.498	8.770	9.009	9.225	9.421	9.602	9.928	10.218
	v	14.57	17.19	19.51	21.82	24.14	26.44	31.06	35.68
0.1	u	2443.9	2515.5	2587.9	2661.3	2736.0	2812.1	2968.9	3132.3
(45.8)	h	2592.6	2687.5	2783.0	2879.5	2977.3	3076.5	3279.6	3489.1
	s	8.175	8.448	8.688	8.904	9.100	9.281	9.608	9.898
	v		34.18	3.889	43.56	4.821	5.284	6.209	7.134
0.5	u		2511.6	2585.6	2659.9	2735.0	2811.3	2968.5	3132.0
(81.3)	h		2682.5	2780.1	2877.7	2976.0	3075.5	3278.9	3488.7
	s		7.695	7.940	8.158	8.356	8.537	8.864	9.155
	v		2.27	2.587	2.900	3.211	3.520	4.138	4.755
0.75	u		2509.2	2584.2	2659.0	2734.4	2810.9	2968.2	3131.8
(92.0)	h		2679.4	2778.2	2876.5	2975.2	3074.9	3278.5	3488.4
	s		7.501	7.749	7.969	8.167	8.349	8.677	8.967
	v		1.696	1.936	2.172	2.406	2.639	3.103	3.565
1.0	u		2506.2	2582.8	2658.1	2733.7	2810.4	2967.9	3131.6
(99.6)	h		2676.2	2776.4	2875.3	2974.3	3074.3	3278.2	3488.1
	s		7.361	7.613	7.834	8.033	8.216	8.544	8.834
	v			1.912	2.146	2.375	2.603	3.062	3.519
1.01325	u			2582.6	2658.0	2733.6	2810.3	2967.8	3131.5
(100)	h			2776.3	2875.2	2974.2	3074.2	3278.1	3488.0
	s			7.828	7.827	8.027	8.209	8.538	8.828
	v			1.285	1.143	1.601	1.757	2.067	2.376
1.5	u			2579.8	2656.2	2732.5	2809.5	2967.3	3131.2
(111.4)	h			2772.6	2872.9	2972.7	3073.1	3277.4	3487.6
	s			7.419	7.643	7.844	8.027	8.356	8.647
	v			0.960	1.080	1.199	1.316	1.549	1.781
2.0	u			2576.9	2654.4	2731.2	2808.6	2966.7	3130.8
(120.2)	h			2768.8	2870.5	2971.0	3071.8	3276.6	3487.1
	s			7.279	7.507	7.709	7.893	8.222	8.513

↓p (bar) (t_s)	t (°C) →	50	100	150	200	250	300	400	500
	v			0.764	0.862	0.957	1.052	1.238	1.424
2.5	u			2574.7	2655.7	2734.9	2813.8	2973.9	3139.6
(127.4)	h			2764.5	2868.0	2969.6	3070.9	3275.9	3486.5
	s			7.169	7.401	7.604	7.789	8.119	8.410
	v			0.634	0.716	0.796	0.875	1.031	1.187
3.0	u			2570.8	2650.7	2728.7	2806.7	2965.6	3130.0
(133.5)	h			2761.0	2865.6	2967.6	3069.3	3275.0	3486.1
	s			7.078	7.311	7.517	7.702	8.033	8.325
	v			0.471	0.534	0.595	0.655	0.773	0.889
4.0	u			2564.5	2646.8	2726.1	2804.8	2964.4	3129.2
(143.6)	h			2752.8	2860.5	2964.2	3066.8	3273.4	3484.9
	s			6.930	7.171	7.379	7.566	7.899	8.191

↓p (bar) (t_s)	t (°C) →	200	250	300	350	400	450	500	600
	v	0.425	0.474	0.523	0.570	0.617	0.664	0.711	0.804
5.0	u	2642.9	2723.5	2802.9	2882.6	2963.2	3045.3	3128.4	3299.6
(151.8)	h	2855.4	2960.7	3064.2	3167.7	3271.9	3377.2	3483.9	3701.7
	s	7.059	7.271	7.460	7.633	7.794	7.945	8.087	8.353
	v	0.352	0.394	0.434	0.474	0.514	0.553	0.592	0.670
6.0	u	2638.9	2720.9	2801.0	2881.2	2962.1	3044.2	3127.6	3299.1
(158.8)	h	2850.1	2957.2	3061.6	3165.7	3270.3	3376.0	3482.8	3700.9
	s	6.967	7.182	7.372	7.546	7.708	7.859	8.002	8.267
	v	0.300	0.336	0.371	0.406	0.440	0.473	0.507	0.574
7.0	u	2634.8	2718.2	2799.1	2879.7	2960.9	3043.2	3126.8	3298.5
(165.0)	h	2844.8	2953.6	3059.1	3163.7	3268.7	3374.7	3481.7	3700.2
	s	6.886	7.105	7.298	7.473	7.635	7.787	7.930	8.196
	v	0.261	0.293	0.324	0.354	0.384	0.414	0.443	0.502
8.0	u	2630.6	2715.5	2797.2	2878.2	2959.7	3042.3	3126.0	3297.8
(170.4)	h	2839.3	2950.1	3056.5	3161.7	3267.1	3373.4	3480.6	3699.4
	s	6.816	7.038	7.233	7.409	7.572	7.724	7.867	8.133
	v	0.230	0.260	0.287	0.314	0.341	0.367	0.394	0.446
9.0	u	2626.3	2712.7	2795.2	2876.7	2958.5	3041.3	3125.2	3297.3
(175.4)	h	2833.6	2946.3	3053.8	3159.7	3265.5	3372.1	3479.6	3698.6
	s	6.752	6.979	7.175	7.352	7.516	7.668	7.812	8.078
	v	0.206	0.233	0.258	0.282	0.307	0.330	0.354	0.401
10.0	u	2621.9	2709.9	2793.2	2875.2	2957.3	3040.3	3124.4	3296.8
(179.9)	h	2827.9	2942.6	3051.2	3157.8	3263.9	3370.7	3478.5	3697.9
	s	6.694	6.925	7.123	7.301	7.465	7.618	7.762	8.029

↓p (bar) (t_s)	t (°C) →	200	250	300	350	400	450	500	600
15.0 (198.3)	v	0.132	0.152	0.169	0.187	0.203	0.219	0.235	0.267
	u	2598.8	2695.3	2783.1	2867.6	2951.3	3035.3	3120.3	3293.9
	h	2796.8	2923.3	3037.6	3147.5	3255.8	3364.2	3473.1	3694.0
	s	6.455	6.709	6.918	7.102	7.269	7.424	7.570	7.839
20.0 (212.4)	v		0.111	0.125	0.139	0.151	0.163	0.176	0.200
	u		2679.6	2772.6	2859.8	2945.2	3030.5	3116.2	3290.9
	h		2902.5	3023.5	3137.0	3247.6	3357.5	3467.6	3690.1
	s		6.545	6.766	6.956	7.127	7.285	7.432	7.702
25 (223.9)	v		0.0870	0.0989	0.109	0.120	0.130	0.140	0.159
	u		2662.6	2761.6	2851.9	2939.1	3025.5	3112.1	3288.0
	h		2880.1	3008.8	3126.3	3239.3	3350.8	3462.1	3686.3
	s		6.408	6.644	6.840	7.015	7.175	7.323	7.596
30 (233.8)	v		0.0706	0.0811	0.0905	0.0994	0.108	0.116	0.132
	u		2644.0	2750.1	2843.7	2932.8	3020.4	3108.0	3285.0
	h		2855.8	2993.5	3115.3	3230.9	3344.0	3456.5	3682.3
	s		6.287	6.539	6.743	6.921	7.083	7.234	7.509
40 (250.4)	v			0.0588	0.0664	0.0734	0.080	0.0864	0.0989
	u			2725.3	2826.7	2919.9	3010.2	3099.5	3279.1
	h			2960.7	3092.5	3213.6	3330.3	3445.3	3674.4
	s			6.362	6.582	6.769	6.936	7.090	7.369
50 (263.9)	v			0.0453	0.0519	0.0578	0.0633	0.0686	0.0787
	u			2698.0	2808.7	2906.6	2999.7	3091.0	3273.0
	h			2924.5	3068.4	3195.7	3316.2	3433.8	3666.5
	s			6.208	6.449	6.646	6.819	6.976	7.259
60 (275.5)	v			0.0362	0.0422	0.0474	0.0521	0.0567	0.0653
	u			2667.2	2789.6	2892.9	2988.9	3082.2	3266.9
	h			2884.2	3043.0	3177.2	3301.8	3422.2	3658.4
	s			6.067	6.333	6.541	6.719	6.880	7.168
70 (285.8)	v			0.0295	0.0352	0.0399	0.0442	0.0481	0.0557
	u			2632.2	2769.4	2878.6	2978.0	3073.4	3260.7
	h			2838.4	3016.0	3158.1	3287.1	3410.3	3650.3
	s			5.931	6.228	6.448	6.633	6.798	7.089

↓p (bar) (t_s)	t (°C) →	350	375	400	450	500	550	600	700
80 (294.9)	v	0.02995	0.03222	0.03432	0.03817	0.04175	0.04516	0.04845	0.05481
	h	2987.3	3066.1	3138.3	3272.0	3398.3	3521.0	3642.0	3882.4
	s	6.130	6.254	6.363	6.555	6.724	6.878	7.021	7.281
90 (303.3)	v	0.0258	0.02796	0.02993	0.03350	0.03677	0.03987	0.04285	0.04857
	h	2956.6	3041.3	3117.8	3256.6	3386.1	3511.0	3633.7	3876.5
	s	6.036	6.169	6.285	6.484	6.658	6.814	6.959	7.222

↓p (bar) (t_s)	t (°C) →	350	375	400	450	500	550	600	700
100 (311.0)	v	0.02242	0.02453	0.02641	0.02975	0.03279	0.03564	0.03837	0.04358
	h	2923.4	3015.4	3096.5	3240.9	3373.7	3500.9	3625.3	3870.5
	s	5.944	6.089	6.212	6.419	6.597	6.756	6.903	7.169
110 (318.0)	v	0.01961	0.02169	0.02351	0.02668	0.02952	0.03217	0.03470	0.03950
	h	2887.3	2988.2	3074.3	3224.7	3361.0	3490.7	3616.9	3864.5
	s	5.853	6.011	6.142	6.358	6.540	6.703	6.851	7.120
120 (324.6)	v	0.01721	0.01931	0.02108	0.02412	0.02680	0.02929	0.03164	0.03610
	h	2847.7	2958.9	3051.3	3208.2	3348.2	3480.4	3608.3	3858.4
	s	5.760	5.935	6.075	6.300	6.487	6.653	6.804	7.075
130 (330.8)	v	0.01511	0.01725	0.01900	0.02194	0.0245	0.02684	0.02905	0.03322
	h	2803.3	2927.9	3027.2	3191.3	3335.2	3469.9	3599.7	3852.3
	s	5.663	5.859	6.009	6.245	6.437	6.606	6.759	7.033
140 (336.6)	v	0.01322	0.01546	0.01722	0.02007	0.02252	0.02474	0.02683	0.03075
	h	2752.6	2894.5	3001.9	3174.0	3322.0	3459.3	3591.1	3846.2
	s	5.559	5.782	5.945	6.192	6.390	6.562	6.712	6.994
150 (342.1)	v	0.01145	0.01388	0.01565	0.01845	0.02080	0.02293	0.02491	0.02861
	h	2692.4	2858.4	2975.5	3156.2	3308.6	3448.6	3582.3	3840.1
	s	5.442	5.703	5.881	6.140	6.344	6.520	6.679	6.957
160 (347.3)	v	0.00975	0.01245	0.01426	0.01701	0.01930	0.02134	0.02323	0.02674
	h	2615.7	2818.9	2947.6	3138.0	3294.9	3437.8	3573.5	3833.9
	s	5.302	5.622	5.188	6.091	6.301	6.480	6.640	6.922
170 (352.3)	v		0.01117	0.01302	0.01575	0.01797	0.01993	0.02174	0.02509
	h		2776.8	2918.2	3119.3	3281.1	3426.9	3564.6	3827.7
	s		5.539	5.754	6.042	6.259	6.442	6.604	6.889
180 (356.9)	v		0.00996	0.01190	0.01462	0.01678	0.01868	0.02042	0.02362
	h		2727.9	2887.0	3100.1	3267.0	3415.9	3555.6	3821.5
	s		5.448	5.689	5.995	6.218	6.405	6.570	6.858
190 (361.4)	v		0.00881	0.01088	0.01361	0.01572	0.01756	0.01924	0.02231
	h		2671.3	2853.8	3080.4	3252.7	3404.7	3546.6	3815.3
	s		5.346	5.622	5.948	6.179	6.369	6.537	6.828
200 (365.7)	v		0.00767	0.00994	0.01269	0.01477	0.01655	0.01818	0.02113
	h		2602.5	2818.1	3060.1	3238.2	3393.5	3537.6	3809.0
	s		5.227	5.554	5.902	6.140	6.335	6.505	6.799
210 (369.8)	v		0.00645	0.00907	0.01186	0.01390	0.01564	0.01722	0.02006
	h		2511.0	2779.6	3039.3	3223.5	3382.1	3528.4	3802.8
	s		5.075	5.483	5.856	6.103	6.301	6.474	6.772
220 (373.7)	v		0.00482	0.00825	0.01110	0.01312	0.01481	0.01634	0.01909
	h		2345.1	2737.6	3017.9	3208.6	3370.6	3519.2	3796.5
	s		4.810	5.407	5.811	6.066	6.269	6.444	6.745

TABLE IV

Supercritical Steam

p (bar)	t (°C) →	350	375	400	425	450	500	600	700	800
230	v	0.00162	0.00221	0.00748	0.00915	0.01040	0.01239	0.01554	0.01821	0.02063
	h	1632.8	1912.2	2691.2	2869.2	2995.8	3193.4	3510.0	3790.2	4056.2
	s	3.137	4.137	5.327	5.587	5.765	6.030	6.415	6.719	6.980
250	v	0.00160	0.00197	0.00600	0.00788	0.00916	0.01112	0.01414	0.01665	0.01891
	h	1623.5	1848.0	2580.2	2806.3	2949.7	3162.4	3491.4	3775.5	4047.1
	s	3.680	4.032	5.142	5.472	5.674	5.959	6.360	6.671	6.934
300	v	0.00155	0.00179	0.00279	0.00530	0.00673	0.00868	0.01145	0.01366	0.01562
	h	1608.5	1791.5	2151.1	2614.2	2821.4	3081.1	3443.9	3745.6	4024.2
	s	3.643	3.930	4.473	5.150	5.442	5.790	6.233	6.561	6.833
350	v	0.00152	0.00110	0.00210	0.00343	0.00496	0.00693	0.00953	0.01153	0.01328
	h	1597.1	1762.4	1987.6	2373.4	2672.4	2994.4	3395.5	3713.5	4001.5
	s	3.612	3.872	4.213	4.775	5.196	5.628	6.118	6.463	6.745
400	v	0.00149	0.00164	0.00191	0.00253	0.00369	0.00562	0.00809	0.00994	0.01152
	h	1588.3	1742.8	1930.9	2198.1	2512.8	2903.3	3346.4	3681.2	3978.7
	s	3.586	3.829	4.113	4.503	4.946	5.470	6.011	6.375	6.666
500	v	0.00144	0.00156	0.00173	0.00201	0.00249	0.00389	0.00611	0.00773	0.00908
	h	1575.3	1716.6	1874.6	2060.0	2284.0	2720.1	3247.6	3616.8	3933.6
	s	3.542	3.764	4.003	4.273	4.588	5.173	5.818	6.219	6.529
600	v	0.00140	0.00150	0.00163	0.00182	0.00209	0.00296	0.00483	0.00627	0.00746
	h	1566.4	1699.5	1843.4	2001.7	2179.0	2567.9	3151.2	3553.5	3889.1
	s	3.505	3.764	3.932	4.163	4.412	4.932	5.645	6.082	6.415
700	v	0.00137	0.00146	0.00157	0.00171	0.00189	0.00247	0.00398	0.00526	0.00632
	h	1560.4	1687.7	1822.8	1967.2	2122.7	2463.2	3061.7	3492.4	3845.7
	s	3.473	3.673	3.877	4.088	4.307	4.762	5.492	5.961	6.307
800	v	0.00135	0.00142	0.00152	0.00163	0.00177	0.00219	0.00339	0.00452	0.00548
	h	1556.4	1679.4	1808.3	1943.9	2086.9	2394.0	2982.7	3434.6	3803.8
	s	3.444	3.638	3.833	4.031	4.232	4.642	5.360	5.851	6.213
900	v	0.00133	0.00139	0.00147	0.00157	0.00169	0.00201	0.00297	0.00397	0.00484
	h	1553.9	1673.4	1797.7	1927.2	2062.0	2346.7	2915.6	3381.1	3763.8
	s	3.419	3.607	3.795	3.984	4.174	4.554	5.247	5.753	6.128
1000	v	0.01308	0.00137	0.00144	0.00152	0.00163	0.00189	0.00267	0.00355	0.00434
	h	1552.7	1669.4	1790.0	1914.8	2043.8	2312.8	2859.8	3332.3	3726.1
	s	3.396	3.579	3.762	3.944	4.126	4.485	5.151	5.664	6.050

TABLE V

Conversion Factors

Force	
1 newton	= 1 kg-m/sec^2
	= 0.012 kgf
1 kgf	= 9.81 N
Pressure	
1 bar	= 750.06 mm Hg
	= 0.9869 atm
	= 10^5 N/m^2
	= 10^3 kg/m-sec^2
1 N/m^2	= 1 pascal
	= 10^{-5} bar
	= 10^{-2} kg/m-sec^2
1 atm	= 760 mm Hg
	= 1.03 kgf/cm^2 = 1.01325 bar
	= 1.01325×10^5 N/m^2
Work, Energy or Heat	
1 joule	= 1 newton metre
	= 1 watt-sec
	= 2.7778×10^{-7} kWh
	= 0.239 cal
	= 0.239×10^{-3} kcal
1 cal	= 4.184 joule
	= 1.1622×10^{-6} kWh
1 kcal	= 4.184×10^3 joule
	= 427 kgfm
	= 1.1622×10^{-3} kWh
1 kWh	= 8.6×10^5 cal
	= 860 kcal
	= 3.6×10^6 joule
1 kgfm	= $\left(\frac{1}{427}\right)$ kcal = 9.81 joules
Power	
1 watt	= 1 joule/sec = 0.86 kcal/[illegible]
1 h.p.	= 75 mkgf/sec = 0.1757 kcal/sec
	= 735.3 watt
1 kW	= 1000 watts
	= 860 kcal/h